ELEVATOR CONTROLS
SIMPLE. SOLID. SUPPORTABLE.

Installation & Adjustment Manual
MODEL V900 Non-PVF SERIES
Prodigy & Standard models
For Microprocessor-Based Traction Elevator Controls
Utilizing AC Vector or SCR Drive Elevator Motor Control

Product Documentation that's Simple to Navigate ™

This is the Installation and Adjustment Manual which is the guide for installation, startup and final adjustment of all Model V900 Non-PVF Series traction elevator controllers. Other resources include:

- **Field Reprogramming Manual** for Model V900/H900 Prodigy & Standard controllers
- **Drive Specific Manuals**
- **Maintenance & Troubleshooting Training Manual** provided in conjunction with Factory and Customer Site technical training classes
- **Telephone Technical Support** available for Customers at no charge
  call: 916/428-1708; **fax**: 916/428-1728; **e-mail**: techsupport@elevatorcontrols.com
- **Onsite Product & Engineering Support** available worldwide by prior arrangement.

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Introduction

Warnings

Throughout this manual, icons will be used to call attention to certain areas of text. These icons represent safety warnings, cautions, and notes.

WARNING: Denotes operating procedures and practices that may result in personal injury and/or equipment damage if not correctly followed.

CAUTION: Denotes operating procedures and practices that may result in equipment damage if not correctly followed.

NOTE: Denotes useful information or procedures.

Throughout this manual it is assumed that field personnel are well qualified in the installation of elevator equipment. No attempt has been made to define terms or procedures that should be familiar to a qualified elevator mechanic.

NOTE: It is assumed that all switches for slowdown, stop, and over travel limits at both terminal landings have been checked for proper type, placement, and operation.

CAUTION: Equipment installation must be in compliance with all Local and applicable Elevator and Electrical Codes and regulations

This manual is intended only to acquaint the service technician with the information required to successfully install the microprocessor-based elevator controller. Field personnel must be familiar with all codes and regulations pertaining to the safe installation and operation of the elevator system.

NOTE: Installation and wiring must be in accordance with the National Electrical Code and consistent with all local codes, and National elevator codes and regulations. The AC power supply to this equipment must be provided through a proper fused disconnect or circuit breaker. Improper protection may create a hazardous condition.

NOTE: Wiring to controller terminals must be done in a neat and careful manner. Stranded wire conductors must be twisted together to avoid strands that would create potential shorts if left out of terminals. All controller and Field terminals and cable connectors must be checked for proper seating and tightness. When connecting flat cable connectors, be certain to match pin #1 marks (arrow symbol on connectors, red stripe on cable) to prevent damage.

CAUTION: Restrict access to elevator control equipment and apparatus to qualified personnel only.

Section 1 – Overview

1.1 Product Description

ELEVATOR CONTROLS CORPORATION model V900 Non-PVF microcomputer based traction Controller utilizes *state-of-the-art large scale integrated circuits* built into a high performance modular circuit board design, in such a way as to optimize *reliability* and *minimize installation* and *maintenance costs.*

The Basic Simplex System contains a Computer Microprocessor Board, P8 for standard controller or PIO9 for Prodigy Controllers, I/O Boards, a Relay Interface Board, Microprocessor Power Supply, Control Transformers, and Starter. The motor control is a DC SCR elevator drive or an AC Variable Voltage Variable Frequency elevator drive unit.

Group Controller G900-XL is available for the control of up to 16 cars.

A *simple to use, powerful diagnostic station* is built into the Computer Microprocessor Board which includes capabilities for *complete on-site re-programming* of the elevator "Personality" parameters via the LCD display.

Video Display, Modem Remote Communications, and Hardcopy Elevator performance printing are all available by means of an output connector capable of driving a standard PC and, including notebook and palm top computers.

V900 Non-PVF Series Specifications

Number of Stops	64 stops Maximum with selective door operation (typical of EC standardized system architecture)
Number of Cars in a Group	16 cars maximum
Environment Limits	32 to 104 Degrees Fahrenheit or 0 to 40 Degrees Celsius 12,000 ft (3,658 m) altitude 95% relative humidity (non-condensing)
Motor Control Options	DC SCR Elevator Drive unit with Encoder or Tachometer feedback
	AC Vector Elevator Drive unit with Encoder feedback for Closed Loop Vector Control
	AC Vector Elevator Drive unit without Encoder feedback for Open Loop Vector Control

1.2 Typical Car Controller Physical Layout

Figure 1.2.1 and 1.2.2 show typical layouts of the V900 Non-PVF Standard and Prodigy car controllers respectively; Following is a brief description of the various components of each controller in Section 1.3.

Figure 1.1 - Typical V900 Non-PVF Standard Controller Layout

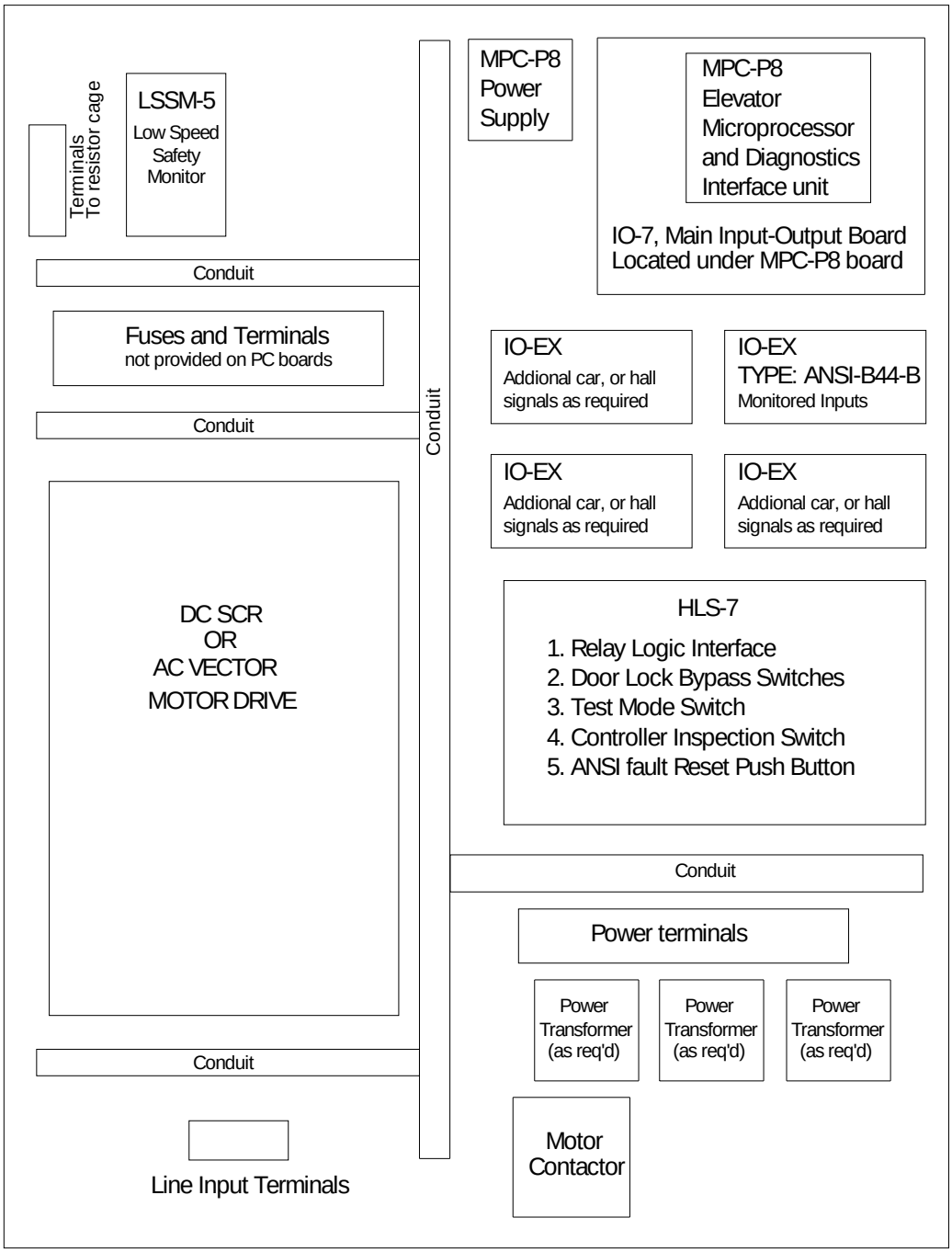
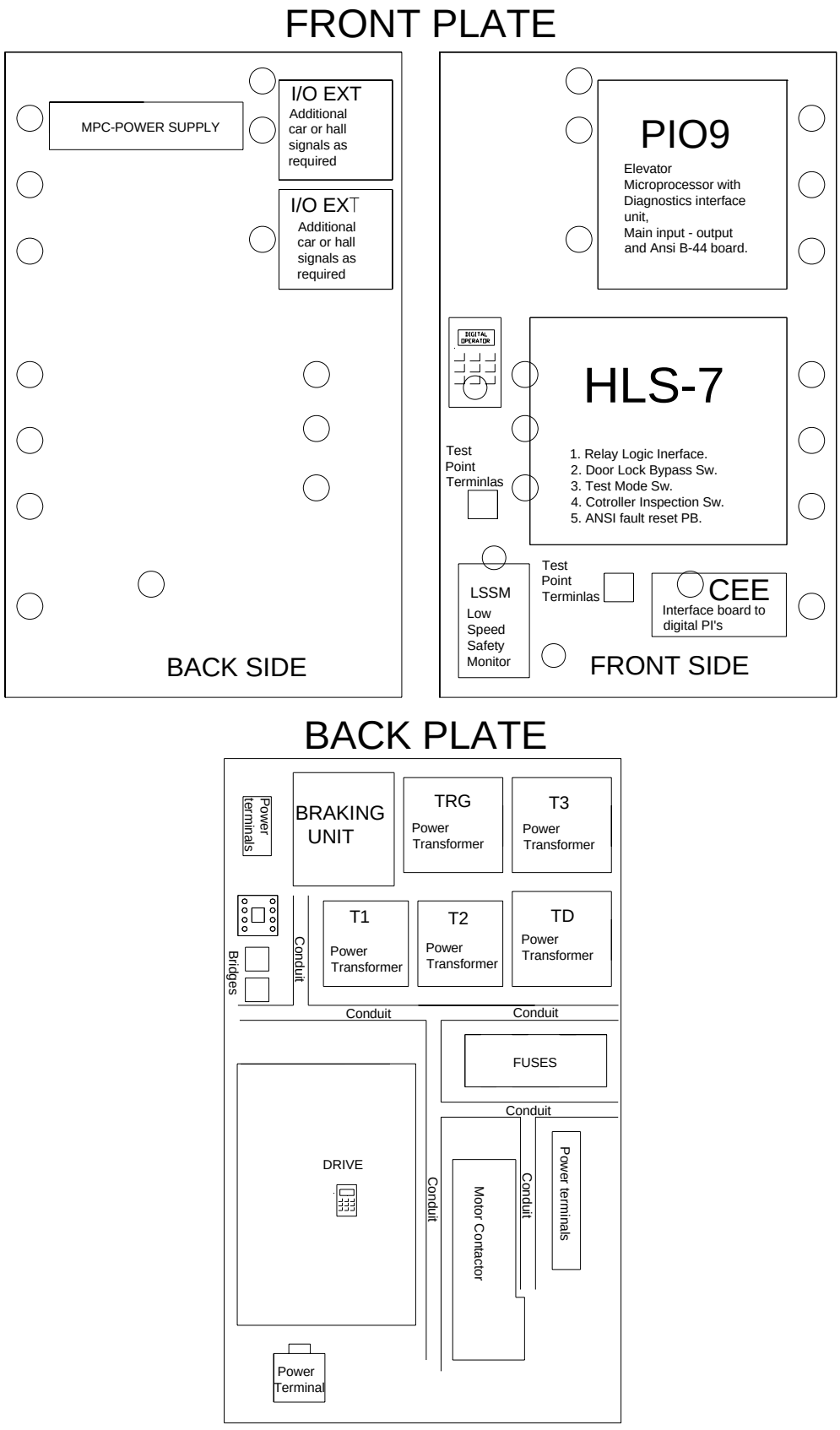


Figure 1.2 - Typical V900 Non-PVF Prodigy Controller Layout



1.3 Components General Function and Description

1.3.1.1 P8 (V900 / H900 Standard Controller Only)

The P8 board is universal to all V900 standard series of Elevator Controls microprocessor control systems, and is used in all types of elevators from hydraulic to traction, and as a main Group dispatcher microprocessor. The P8 board utilizes high speed, microprocessor technology with a high level of system integration.

✍ **NOTE**: P8 microprocessor board may also be called MPC-P8 microprocessor board.

The P8 board contains an Onboard Menu Driving Diagnostics Tool coupled with a 2 x 16 alphanumeric display that allows full system reprogramming and diagnostics, four serial ports, a parallel port, an HSO high speed clocked serial port, and a real time clock. System ports are assigned as follows:

- COM1 (IBM) standard RS232 to drive IBM compatible systems
- COM2 (Duplex) duplex port for communication of duplex systems
- COM3 (PVF) communication with position velocity processor (Not used by V900 Non-PVF controller)
- COM4 (Group) communication with the group G900 processor
- HSO Communication for Ez-LINK^{TM} serial network system P8X microprocessor
- LPT1 (Dispatcher) parallel data communication with G900 processor, when P8 is used as Dispatcher processor

The P8 board is responsible for all the decision making for the elevator's automatic mode of operation, and the monitoring of inputs and outputs for ASME-17.1A-2000 code compliance.

1.3.1.2 PIO9 (V900/ H900 Prodigy Controller Only)

The PIO9 board is universal to all Prodigy series of control systems, and is used in all types of elevators from hydraulic to traction. The PIO9 board utilizes high speed, microprocessor technology with a high level of system integration.

The PIO9 board contains: an Onboard Menu Driving Diagnostics Tool coupled with a 2 x 16 alphanumeric display that allows full system reprogramming and diagnostics, four serial ports, an HSO high speed clocked serial port, and a real time clock. System ports are assigned as follows:

- COM1 (IBM) standard RS232 to drive IBM compatible systems
- COM2 (Duplex) duplex port for communication of duplex systems
- COM3 (PVF) communication with position velocity processor (Not used by V900 Non-PVF controller)
- COM4 (Group) communication with the group G900 processor
- TOC and HALL serial ports for Ez- LINK^{TM} serial network

The PIO9 board is responsible for all the decision making for the elevator's automatic mode of operation, and the monitoring of inputs and outputs for ASME-17.1A-2000 code compliance.

The PIO9 board absorbed several of the discrete boards used on the standard controller by utilizing surface mount technology and, by having fixture voltage fixed to 24 volts DC. The boards absorbed were P8, IO-7, IO-EX-B44, P8X, and one IO-EX board.

1.3.2 I/O-7 (V900/ H900 Standard Controller Only)

The I/O-7 is the main input-output board used in all the elevator control standard systems except for the group controller. It provides all of the main inputs and outputs required to run the elevator, such as safety inputs and door control signals. Such signals are permanently labeled on the left and right sides of the board.

The connector at the right top area of the board permanently contains the first 4 position indicators, direction arrows, fire buzzer and indicator outputs which drive the actual position and fire fixtures. Different types of IO-7 boards are provided, ranging from 110AC Standard to 24DC. When replacing this board, be sure that the type and voltage match the one being replaced, and that the LED power select jumpers are placed in the same positions.

1.3.3 IO-EX

The I/O-EX board provides all inputs and outputs that cannot be accommodated within the I/O-7 or PIO9 board, including car calls, hall calls, hall gongs, position indicators, etc. Voltage and LED power select jumper positions are critical (as with the I/O-7 above) so care must be exercised when replacing this board. Note that the I/O-EX may not be present in all control panels.

1.3.4 IO-EX-B44-B (V900/ H900 Standard Controller Only)

The I/O-EX-B44-B board provides ASME-17.1A-2000 redundancy inputs and outputs. Voltage and LED power select jumper positions are critical (as with the I/O-7 above) so care must be exercised when replacing this board. Note that the I/O-EX-B44-B- may not be present in all standard control panels.

1.3.5 HLS-7

The HLS-7 board is the main relay panel board, housing all the relay logic to interface to the elevator system door control, starters, selector, etc. It should be noted that the HLS-7 does not contain any “Smart” logic. It is a basic board that has been developed to replace point-to-point wiring with a more cost effective and reliable solution. The HLS-7 is configured per job using onboard jumper configurations and relays types loaded for ND, BH, RUN and DPX.

1.3.6 Entry intentionally left blank

1.3.7 LSSM-5

The LSSM-5 board contains independently driven speeds monitoring circuits required by elevator safety standards. These include overspeed, leveling speed monitoring, terminal slowdown speed monitoring, and inspection speed monitoring. The LSSM-5 accepts two types of feedback: (1) a DC tachometer feedback or, (2) pulses from a hall-effect sensor working in conjunction with magnets surrounding the motor drive sheave.

NOTE: The COP, TOC boards are used when the elevator control system is designed with serial communications to the top of the car and the car operating panel.

The Hall boards are used when the elevator control system is designed with serial communications to the hall stations. Skip 1.3.8 to 1.3.12 for standard or Prodigy non-serial elevator systems without "Ez-LINK."

1.3.8 COP

The COP microprocessor board gathers all signals from the COP buttons such as car calls; door open and door close buttons, fire service, etc and transmits such information via RS-485 to the TOC board. It also receives all output information for car call outputs, passing chime, fire indicators, etc. from the TOC through the same RS-485 communications channel.

The COP board serves as interconnection point for signals, that can't be transmitted via serial communication, on their way to the traveling cable. Examples include emergency stop switch bypass, in car inspection, etc.

The COP board is linked to the TOC board via two twelve pin terminal connectors, housing all interconnects and shielded communication twisted pairs. When replacing the COP board, make sure that all board configuration jumpers are placed matching those on the board being replaced.

1.3.9 TOC

The TOC microprocessor board gathers all signals from the top of car including the selector unit, door operator limit switches, load weighing device, car top inspection station, etc. It also receives all information from the COP board front (and rear, if elevator has rear doors) via an RS-485 channel dedicated for communications between TOC and COP boards. This information is then combined with locally gathered information, and transmitted via RS-422 to the P8X board for standard controllers or to the PIO9 for Prodigy controllers.

The TOC board receives all output and control information from the P8X or PIO9 for door control and other information on its way to the COP board through the same RS-422 communications channel.

The TOC board serves as interconnection point for signals, that can't be transmitted via serial communication, on their way to the traveling cable. Examples include emergency stop switch bypass, in car inspection, power supplies etc.

The TOC board serves as interconnection point for signals, that can't be transmitted via serial communication, on their way to the traveling cable. Examples include emergency stop switch bypass, in car inspection, power supplies etc.

The TOC board is linked to the elevator controller via traveling cable. This cable contains three ten pin terminal connectors (which house all interconnects) and two sets of two twisted shielded pairs for communication.

When replacing the TOP board, make sure that all board configuration jumpers are placed matching those on the board being replaced.

1.3.10 COP-EX

The COP-EX board is a sixteen general input/output board that is used to accommodate signals not being housed by the COP or the TOC board such as car calls, attendant service, line per floor position indicators, etc.

When replacing the COP board, make sure that all board configuration jumpers are placed matching those on the board being replaced.

1.3.11 HALL

The HALL board is used at each landing in a multi-drop configuration. This board gathers hall call information, per opening, and transmits this information to the P8X or PIO9 board via RS-485 communication path. It also receives information that illuminates and extinguishes hall calls indicator lights and sounds hall gongs.

CAUTION: The HALL board is configured for a particular floor layout through SW1, an eight-switch pack (dip switch). When replacing the HALL board, make sure the dipswitch positions match those on the board being replaced, or permanent damage to one or more boards in the hall loop may occur.

1.3.12 P8X (V900/ H900 Standard Controller Only)

The P8X board is attached to the back of the P8 main elevator microprocessor. It communicates with the P8 via a high-speed port, HSO. The P8X function is to gather all information from the elevator serial network, from the COP-TOC, and hall station HALL boards, which is then conveyed to the elevator microprocessor. The P8X board also receives all process commands from the P8 board and distributes commands on the network, relieving the P8 microprocessor from any communications burden.

1.3.13 Power Supply

The power supply has a single linear output that provides +5VDC for all microprocessor logic, and provides power to boards including P8, or PIO9, IO-6, IO-EX-B44-B and IO-EX. Typical part: Power-One HB5-3/OVP, 3 Amps @ 5VDC.

1.3.14 Power Supply Transformers

Power supply transformers are provided as necessary, according to the power requirements of each individual job, to step down and/or provide power isolation from the main power AC line.

1.3.15 Door Operator Interface Logic

Logic is provided as required for control of the various door operators and configurations used in the industry.

1.3.16 Fuses and Terminals

Fuses, terminals, and any miscellaneous job-specific circuits not part of the standard PC board set are provided as required for each specific job.

1.3.17 Motor Control Units

Elevator Controls utilizes several brands of DC-SCR and AC-Vector motor drives unit. Please refer to the manufacturer's drive manual, provided with the controller information package, for details on the motor drive unit for each particular job.

✍ **NOTE**: See 1.3.17.1 or 1.3.17.2 for the appropriate motor control information for your project.

1.3.17.1 SCR Motor Control & Starter Unit for DC Motors

The DC elevator motor drive consists of three distinct control components as follows:

a. The motor drive unit controls motor speed by applying a variable DC voltage to the motor armature and motor field. Input from a motor-shaft mounted encoder or tachometer unit provides closed loop feedback.

b. The motor contactor isolates the motor from the motor drive unit for safety in the event of a drive malfunction.

c. An optional drive isolation transformer and DC-choke filter. The transformer isolates the DC-SCR to prevent induced noise from affecting the building's power supply. The DC-choke filters the current supplied to the motor armature by the DC-SCR drive to prevent audible noise from being generated.

1.3.17.2 AC Vector Motor Control & Starter Unit for AC Motors

The AC vector drive consists of three distinct control components as follows:

a. Regeneration circuits dissipate motor back-EMF to the line, for line regenerative drives, or to a bank of resistors (through a braking transistor) for non- regenerative drives.

b. The motor drive unit controls motor speed by changing the output motor voltage and frequency. Input from a motor-shaft mounted encoder unit, for Closed Loop Vector control systems, provides closed loop feedback. This is not required for Open Loop Vector control systems.

c. The motor contactor isolates the motor from the motor drive unit for safety in the event of a drive malfunction.

Section 2 – Preparation

2.1 General Information

This section contains important instructions and recommendations pertaining to the site selection environmental considerations, and wiring guidelines to ensure a successful installation.

2.2 Site Selection

While selecting the best location for the controller equipment take into account the following factors:

a. Make sure the control system is placed logically, while taking into consideration the rest of the equipment location.

b. Provide adequate working space for installation, wiring, and maintenance of the control system. Please note that rear access is not required on Elevator Controls standard control systems.

c. Do not install equipment in a hazardous location.

d. Do not install equipment in areas or on surfaces where it will be subject to vibration, the control systems contains parts such as relays that are placed in sockets whose functions may be affected by vibration.

e. Provide adequate lighting and working space for comfort and efficiency; a telephone line is desirable to provide access for optional remote diagnostics, as well as more efficient access to E.C.C. factory technical support if required.

2.3 Environmental Considerations

For proper operation and longevity, the elevator control system should be installed according to the following requirements:

a. The temperature inside the control system enclosure should be maintained between 32 to 104 degrees Fahrenheit (0 to 40 degrees Celsius). Higher or lower temperatures will reduce the life of the system and may prevent the system from functioning normally. Provide air-conditioning if required.

b. The air in the machine room should be free of corrosive gases. Air should be sufficiently dry to prevent condensation from moisture. NEMA 4 or NEMA 12 enclosures with integral air-conditioning units are available for these applications.

c. Avoid placing any control system cabinet or component near windows to prevent severe weather conditions from damaging the equipment.

d. Extreme levels of Radio Frequency (RF) radiation should be avoided. Radio Frequency Interference (RFI) may interfere with the operation of the control system. Elevator Controls hydraulic control systems have been tested by CKC Laboratories, Inc. Report Number IM00-029 and found to be in compliance with EN61000-4-2, EN61000-4-3 and EN61000-4-4 in accordance with EN12016 regulations.

NOTE: Hand-held communications devices used close to the system computers may generate disruptive RF interference.

2.4 Recommended Tools, Test Equipment and Manuals

The following tools are recommended for installation of V900 Non-PVF control system:

a. Digital multi-meter

b. Assorted electronic tools such as pliers, cutters, flash light, Elevator Controls small screwdriver (supplied with each controller), etc

c. Amp-Prove probe-type ammeter

d. Telephone

e. Test weights

f. Control system “as built” wiring prints

g. This manual

h. Model V900/H900 Prodigy & Standard P8 Field Reprogramming manual

i. Motor Drive Control Manual (SCR or AC-Vector as required)

j. Oscilloscope and Meg-Ohm meter may be desirable for advanced troubleshooting (rarely required)

k. Tachometer to determine the elevator’s actual car speed

2.5 Controller Installation Guidelines

NOTE: It is very important to follow control system wiring guidelines to prevent problems with interference and line pollution.

NOTE: Wiring to controller terminals must be done in a neat and careful manner. Stranded wire conductors must be twisted together to avoid strands that would create potential shorts if left out of terminals. All terminals and cable connectors must be checked for proper seating. When connecting flat cable connectors be certain to match pin #1 marks (arrow symbol on connectors, red stripe on cable) to prevent damage.

CAUTION: Restrict access to elevator control equipment and apparatus to qualified personnel only.

There are five different entry points that should be maintained separate while wiring the control system:

a. Power wiring: the line power coming from the elevator service disconnect with power ground.

b. Motor wiring: power to hoist motor, brake and ground.

c. Safety and Logic wiring: all wiring to fixtures and switches, as well as cross-connect signals from one car to another in a multi-car group system.

d. Communications cables: communication cables run from one controller to another in a group of two or more cars.

e. Encoder Feedback cables and Low Speed Monitor: cables used to deliver motor performance information from the encoder or Tachometer unit to the drive unit for speed control (for closed loop control applications only), and also to provide independent motor speed rotation feedback data to the Low Speed Monitor, LSSM-5, board.

NOTE: Both encoder feedback and LSSM-5 feedback cables can be placed together in the same metal conduit.

WARNING: Do not connect the building power supply directly to the motor contactor, as this will damage power transistors in the drive unit.

NOTE: Study your control system layout to achieve the best arrangement, keeping the five entry points separated and positioned logically to suit the particular control system you will be installing. Following are the proposed layout for wiring a standard and a Prodigy controller.

NOTE: The standard NEMA-1 enclosure provided for V900 Non-PVF Standard or Prodigy controllers includes factory knockouts, which suggest locations for wiring entry points. These knockouts are located as follows: one on the top right side of the enclosure for the communication cable; and three on each side of the lower portion of the enclosure for other required wiring.

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Figure 2.1 – Typical V900 Non-PVF Standard Controller Wiring Layout

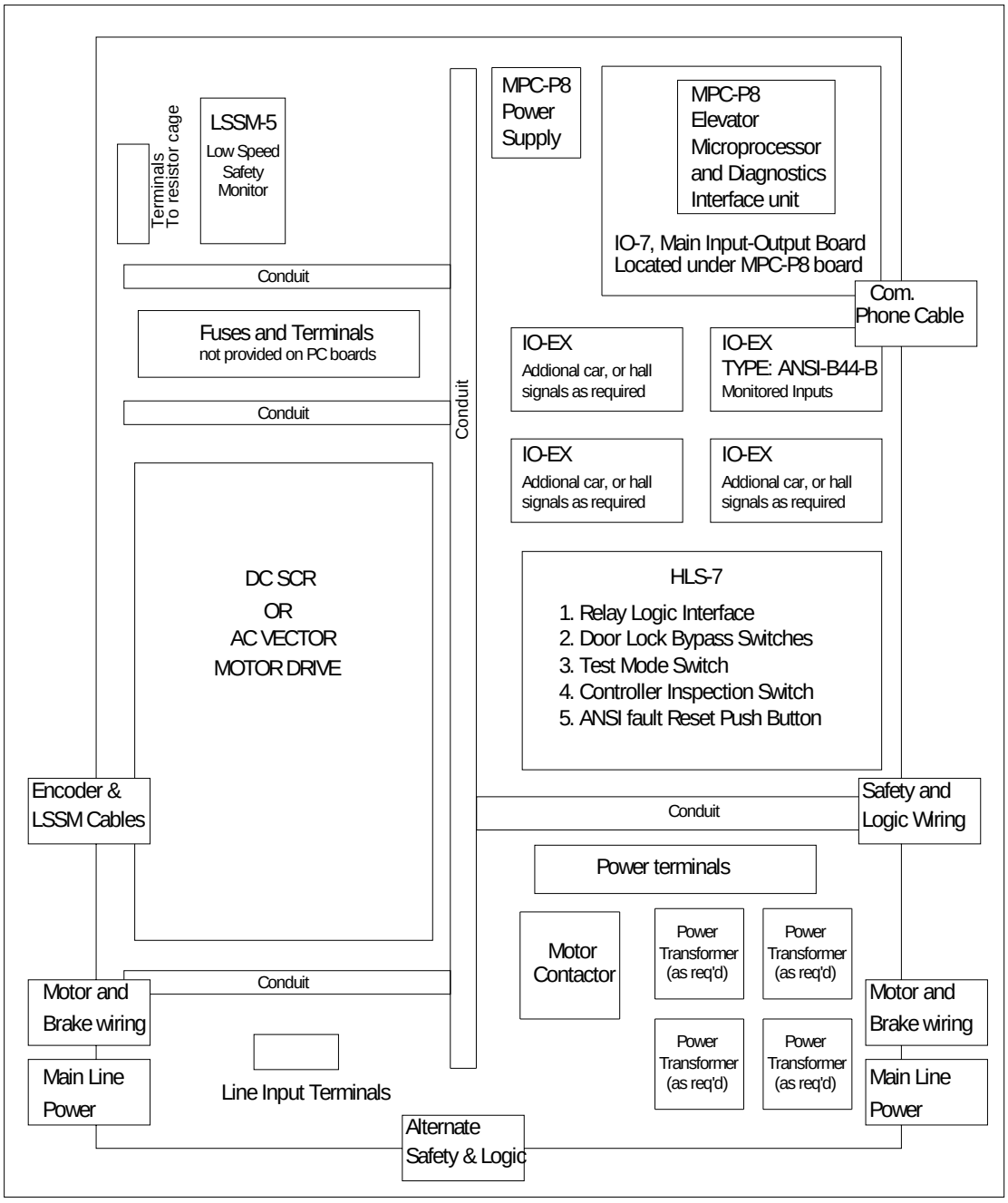
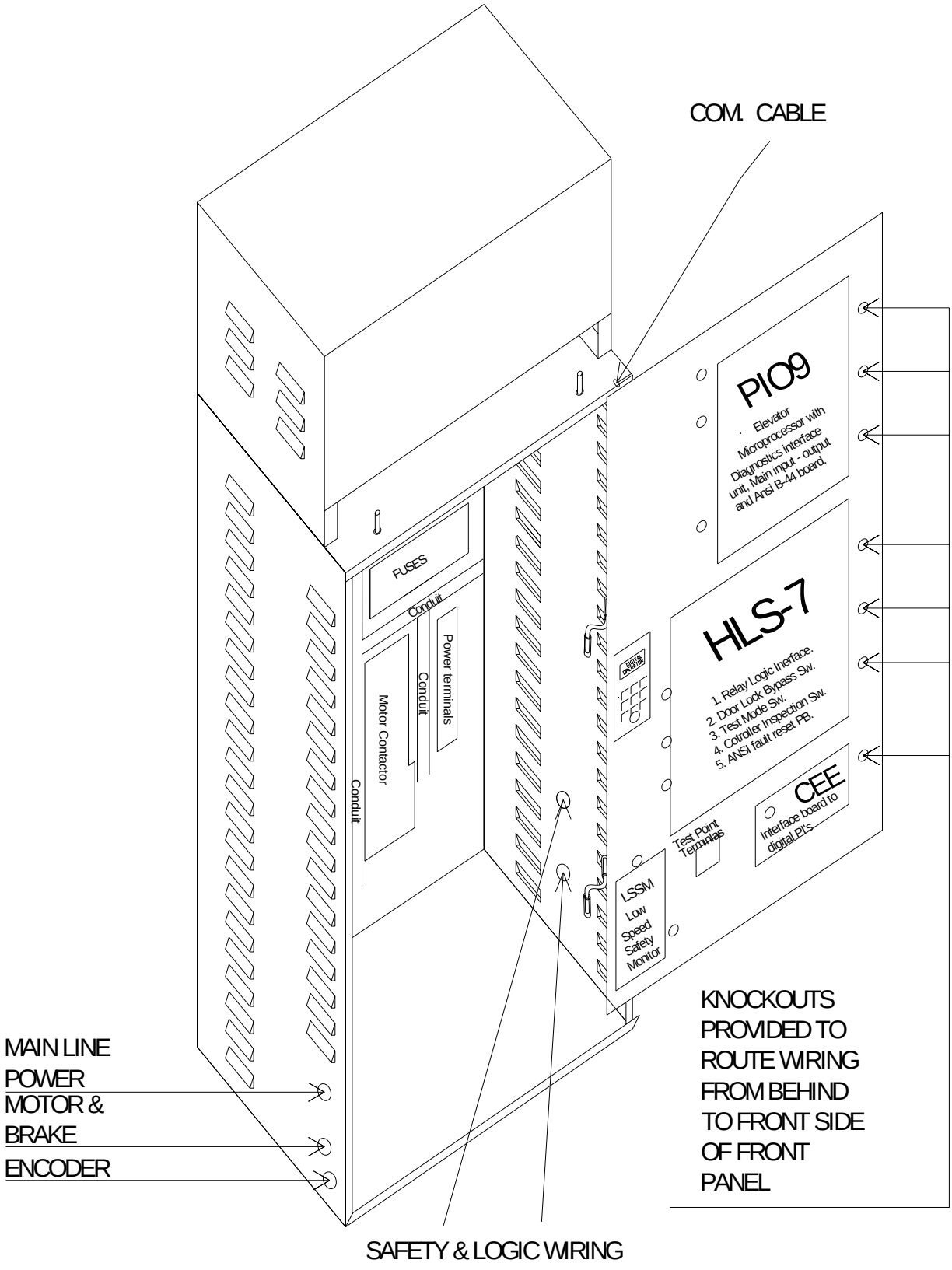


Figure 2.2 – Typical V900 Non-PVF Prodigy Controller Wiring Layout



Section 3 – Startup

3.1 General Information

Protect printed circuit boards from dust and foreign materials. Remove main fuses. Complete elevator controller mounting installation and wiring. Observe controller field terminal locations in relation to wiring ducts in order to determine optimum locations for wiring to enter the control equipment enclosure.

NOTE: The standard V900 Non-PVF controller enclosure has several ¾" knockouts marked for wiring ducts which can be used as guides for location of knockouts required for each particular job.

CAUTION: Use care to protect circuit boards from metal debris when cutting.

CAUTION: Do not connect the building power supply to the motor contactor.

CAUTION: Power capacitors in the drive remain charged for some time after power is removed. Use caution to prevent shock injury.

3.2 Startup of the V900 Non–PVF Microprocessor Control System

NOTE: These are not instructions for final adjustment.

In the following instructions it is assumed that all hatch doors are closed but not necessarily locked and all hoistway and machine room wiring is complete.

These instructions assume that the installer has a working knowledge of electrical troubleshooting. Follow prescribed procedures carefully.

If the elevator does not respond as expected, check the circuits according to your ability. If you can't locate the problem in a reasonable time, call in an adjuster or serviceman with advanced troubleshooting experience. Proceed with caution.

NOTE: You will find multiple LED indicators on PC boards and onboard computer diagnostics very useful tools that will save installation and troubleshooting time.

Read these instructions all the way through before starting work to become familiar with the entire procedure.

3.2.1 Test Ground Continuity

Test all terminals for continuity to ground. If continuity is identified, remedy the problem before proceeding.

NOTE: Terminal 3 is connected to ground and is used as system common.

3.2.2 Remove Group System Fuses (if applicable)

Make sure supervisory control system supply fuses are removed.

3.2.3 Remove Primary Controller Fuses

Remove fuses F4, F7, F8, FB1, and FB2 to disable primary controller relay voltage, brake control circuits, and the door operator. Place controller INSP and TEST switches in inspection and test positions, respectively (on).

NOTE: Always review prints to double check fuse designations and correct amperages, as well as to become familiar with job specific circuit requirements.

3.2.4 Check Disconnect Switch

Check the line side of the disconnect switch and verify all three legs are at the correct voltage.

CAUTION: Remove protective covering on PC boards and components before applying power.

WARNING: Make sure power is within 10% of specified control voltage or permanent damage could occur to both the motor drive unit and elevator control logic. Turn off the main line disconnect and correct any voltage problem before proceeding with installation.

3.2.5 SH6 "Serial Safety" Jumper for Serial Link to Top of Car

NOTE: If serial link to Top of Car is not used, skip to next step, 3.2.6.

Place the SH6 jumper on the HLS-7 board (which is located in front of the JDRK2 harness connector) to allow the safety string to be made without the TOC and COP boards being wired to the elevator system. This will permit car movement on Inspection mode; Refer to page 3 area 3 of job prints for reference on jumper function, which is to bypass the circuit that confirms that TOC and COP boards are in place.

3.2.6 Turn on Main Line Disconnect

Turn on the disconnect switch. For DC-SCR, check voltages at L1, L2, and L3 terminals located towards the top of the DC-SCR drive unit. For AC-Vector, check voltages at the Marathon terminal block or on the EMI-RFI filter input terminals, if job has been provided with such filters.

NOTE: For Prodigy controllers the drive unit and power terminals are located behind the front the panel, on the back panel.

3.2.7 Verify Hoist Motor and Brake Information

Verify the actual Motor and brake data versus the controller data on job prints page 4 area D3. If prints data differs from actual values, call Elevator Controls for assistance in recalculating Hoist Motor parameters and recalibrating brake circuits.

✍ **NOTE**: Actual Hoist Motor and Brake information must match programmed parameter information for elevator system to work properly. Make necessary adjustments before proceeding forward.

3.2.8 Index to Motor Drive Parameters Appendix

This section directs you to the appropriate appendix section of this manual for the various drive units utilized with the V900 Non-PVF control system. Refer to the appendix section as it applies to your specific motor control unit as follows:

For example, if working with a Magnetek SCR drive system and a reference such as "Adjust the drive gain, refer to Section 3.2.8 entry x.2.2 of this manual to hold car…" is made in reference to Appendix B1 Section B1.2.2 If same reference is made for a Yaskawa F7 drive unit, it is referring to Appendix A1 section A1.2.2

3.2.8.1 Appendix A – AC Vector Motor Control Drives

A1 Yaskawa F7 drive unit

A2 Magnetek HPV-900 drive unit

A3 Magnetek HPV-600 drive Unit

A4 KEB Combivert F5 drive Unit

3.2.8.2 Appendix B – SCR Motor Control Drives

B1 Magnetek DSD-412 drive unit

✍ **NOTE**: Read through the Drive Manual section, "**Drive Parameters Overview"** pertaining to the appendix corresponding to the drive unit used in your particular installation before proceeding to Section 3.2.9.

Skip to Section 3.2.9 if not a KEB Combivert F5 Drive unit with Permanent Magnet Gearless motor elevator system application.

✍ **NOTE**: KEB Combivert F5 Drive when used to drive Permanent Magnet Gearless motor elevator systems, the drive unit will have to learn the position of the encoder vs. motor every time the encoder is replaced, repositioned, or during start up, to be able to generate proper motor torque control.

☠ **WARNING**: Do not attempt to move the car before making sure all variables are set per actual motor requirements, and section A4.2.2 of Appendix A4 has been successfully performed.

✍ **NOTE**: Do not proceed further until step A4.2 of Appendix A4 has been successfully performed.

3.2.9 Verify Safety Switches

Verify that car, car-top stop and any other safety switches are set and operating properly. In order for the elevator monitoring system to permit movement of the elevator, the following conditions must be met:

a. Governor switch, governor contact must be wired between Terminals 4A and GOV.

b. The emergency stop switch must be wired between Terminals 4A and 17, and 17A to 17B for emergency stop switch monitor input, and the safety switches between Terminals 17 and 23. Refer to job prints page 3.

c. The Motor Drive Unit, Drive On relay output should be on, completing the controller main safety string if the Motor Drive unit is in a normal mode of operation, no faults being detected.

d. The UP (Terminals 28 and 30) and DOWN (Terminals 29 and 33) normal limits must be made.

f. The car gate (Terminals 4 and CG) must be made, as well as the hoistway door safety string, bottom door locks (Terminals 4S and 19), intermediate door lock (Terminals 19 and 13), and top door lock (Terminals 13 and THD).

g. The Door Open Limit (Terminals 4 and DOLF) must be closed and the Door Close Limit (Terminals 4 and DCLF) must be opened. If equipped with selective rear doors, the rear Car Gate and Door Open and Close limits must follow the same status as the front limits.

h. The Emergency Brake "Rope Gripper" contacts, between Terminals BC1 and BC2, must be made to allow power to flow in the directional circuits (refer to job print areas 4 and 5).

i. Remove the SH2 jumper from the LSSM-5 board in order to bypass trip latching of the ST relay on the LSSM-5 speed monitor board during job installation.

j. If the controller is equipped with the Ez-LINK serial communication option, install the SH6 "SERIAL LINK" jumper on HLS-7 to enable safeties to set without the COP and TOC boards being installed.

✍ **NOTE**: Circuits above will allow the car to move on Car Top Inspection mode of operation.

✍ **NOTE**: In order to allow the car to be run on Controller Inspection, car top inspection, in-car inspection, and Access mode switches must be in the off position. Car Top Inspection (4 to ICTO), In Car Inspection (ICTO to ICIO), Access (INAC to INAO), and Hall & Car Door Bypass switches in controller must be on normal position.

✍ **NOTE**: If elevator installation does not require In Car Inspection or In Car Access, jumper the respective terminals above to permanently disable these functions.

3.2.10 Temporary Final Limit Jumper

If the car is at the top, or at the bottom of the hoistway, jumper the final limit terminals 17 to 23 to allow the car to move. **REMOVE THIS JUMPER** AS SOON AS IT IS POSSIBLE TO DO SO. Use the UP/DN rocker switch to control car movement.

✍ **NOTE**: Local elevator safety code may not allow the use of a controller Inspection switch. In this case, the car top inspection station should be used to run the car.

If no relays are picked, check, fuse F4 and verify that 110 VDC is present between Terminals 3 and 4A, and also between Terminal 4 and 3. If voltage is present on Terminal 4A but not on Terminal 4, turn to page 3 area 3 of the prints and verify the Emergency Stop and Elevator Safeties field wiring.

3.2.11 Running the Car on Inspection

3.2.11.1 Signals Required for Drive Unit to Drive the Hoist Motor

The required signals to command the drive unit to start driving the hoist motor are provided by the control system via relay logic interface. Refer to page 4, areas D1 and D2 of job prints as follows:

Control Signals	Relay Contact	Harness Connector Pin #
Run Up (Forward)	U Relay contact #6 N/O	JDV-1
Run Down (Reverse)	D Relay contact # 6 N/O	JDV-2
Final Leveling Speed	DZ Relay contact #5 N/O	JDV-5
Leveling Approach Speed	DZ Relay contact # 2 N/C	JDV-4
Approach Speed/ Insp.	LVL Relay contact # 2 N/C	JDV-6
High Speed	H Relay contact # 5 N/O	JDV-4 & JDV-6
Second Deceleration	BK-Aux contact # 1 N/C	JDV-13
Earthquake Speed		JDV-4, JDV-5 & JDV-6

Drive Signals	Print Page Location	Harness Connector Pin #
Drive Ready	Page 3 Area 3	JDV-10, JDV-11, JDV-12
Drive ON	Page 4 Area D2	JDV-9
At Speed	Page 5B Area A2	JHN-1

✍ **NOTE**: Encoder feedback is required only for AC Closed Loop Vector control and DSD-412 DC-SCR drive.

3.2.11.2 Verify Safeties

Verify that the main safety circuit SAF input LED is lit. This LED is located on the IO-7 or PIO9 board. The IO7 board is located below the P8 microprocessor board for standard controllers. If the SAF LED is not on when the car is on inspection, trace the safety circuit, referring to job prints Page 3 area 3, to locate the problem.

✍ **NOTE**: When no faults exist, the drive will normally pick the DSAF relay.

3.2.11.3 Car Direction

✍ **NOTE**: For KEB Combivert F5 Drive when used to drive Permanent Magnet Gearless motor elevator systems, Skip to section 3.2.11.4 below (3.2.11.3 has been verified as part of section 4.2 of Appendix 4).

Place the controller on inspection by placing the controller inspection switch in the inspection position. Run the car using the UP/DN switch on the controller. Car Top inspection, In Car Inspection and Access switches will need to be off in order for the controller UP/DN switch to work. If the car runs backwards, for AC-Vector control systems interchange two of the three motor leads from the bottom of the Delta contactor for SCR control systems interchange the two armature wires at the top of the Delta DC Contactor.

✍ **NOTE**: Use care not to interchange the input power leads.

✍ **NOTE**: For Closed Loop applications only, if motor rotation is correct, verify that the motor does not produce unusual noise or vibration. Refer to the drive manual for details on Faults indications. If the pulse generating encoder direction is incorrect, the drive will typically trip, or the car will move very slowly or erratically, irrespective of the speed setting. Reverse the encoder direction by reversing encoder leads A and A/. If this doesn't resolve the problem, check the encoder signal wiring.

3.2.11.4 Brake Adjustment

While attempting to run the car, adjust brake voltage to the desired values for brake picking and holding voltages as required, following instructions found on prints Page 4, area D3.

✍ **NOTE**: Brake power resistors are located inside the resistor cage on top of the controller.

3.2.11.5 Set Inspection Speed

An inspection speed setting between 20 to 50 FPM is desirable during the installation phase. Program approach speed parameter to desired speed. Refer to Section 3.2.8 entry x.2.3 of this manual for parameter setting and speed calibration instructions.

3.2.11.6 Brake Mechanical Operation

Prove that the brake will properly hold at least an empty car. Perform any necessary mechanical adjustments to obtain proper brake operation.

3.2.11.8 Verify Hoistway Clearances

Verify safety circuits between Terminals 4A and 24 and make any necessary corrections. Refer to page 3, area 3 of the job prints. Check the car top stop switch to enable/disable inspection up and down buttons. Inspect the full length of the hoistway to ensure the availability of required free running clearances. Check all door locks to ensure proper clearances have been maintained.

3.2.11.9 Verify Limit and Slowdown Switches

Check inspection access operation, (if provided), including proper operation of door lock bypass detection.

NOTE: The elevator safety code does not allow operation of the elevator on inspection access operation if the door locks are bypassed.

Be sure TM switches or slowdown limits, stop limits, and overtravel limits are all properly set according to the hoistway print.

3.2.11.10 Controller Connectors Seating

Verify that all connectors in the system are correctly seated. Ribbon and plug-in field wire connectors can wiggle loose when the system is being worked on. Press firmly on all connectors to seat them. Be sure duplex cables are installed along with any #18 wire cross connections (if more than one car) according to the hoistway print. Install F50 fuse if used on this controller.

CAUTION: Proper seating and secure latching of all connectors is critical to reliable system operation.

3.2.12 Complete Installation

At this point the system startup is complete: the elevator car should run correctly on inspection. If you are still having problems, review the steps above and repeat as necessary. The elevator system installation should now be completed, including installation of the selector, etc.

Before running the system on automatic operation, follow steps 3.2.12. through 3.4.3, and complete steps described in Section 4 of this manual.

3.3 Selector Signal Verification

3.3.1 Set Dead Zone

Verify and adjust (as required) the leveling switches on the car top for proper Door Zone dead zone, +/- 1/4". Correct vane lengths and switch arrangements are specified on job prints and selector reference materials.

NOTE: LU and LD, at Terminals 25 and 26 to Terminal 3 respectively, need to be off (0 VDC) when the car is at floor level.

Make sure all hoistway doors and car doors are closed and locked. Run the car on inspection mode through the entire hatch, making sure it is clear of obstructions.

3.3.2 Stepping Selector Signals Verification

The V900 Non-PVF control system utilizes fixed signals from the hoistway to generate car position, and acceleration/ deceleration speed profiles, which are generated by the selector system.

While on the cartop, while running the car on Inspection, verify that at every floor the selector generates DZ (Door Zone), LU (Leveling UP), LD (Leveling Down), STU (Step Up), and STD (Step Down) signals. Accomplish this by observing the LED indicators provided inside the selector cartop box, for cars using IP-8300 selector system, or the TOC board for cars equipped with the Ez-Link serial communication option.

3.4 Proper Stepping Sequence

This section is intended to describe the state of the stepping signals required to execute an automatic run, and to illustrate how the elevator computer, P8 or PIO9, keeps track of the car movements as it travels from floor to floor.

3.4.1 Initial Selector Status

While Car is at a landing floor level…

a. The DZ indicator LED will be lit, indicating car is at floor level.

b. STU/STD signals LED's will be lit. Indicating stepping inputs are not active, i.e. they are active low.

3.4.2 Re-Arming the Selector

a. As car travels out of the door zone area, the DZ indicator should turn off.

b. The STU (or STD for down) indicator will turn off as the car passes through the selector vane signaling the P8 or PIO9, of stepping signal activation, the P8 or PIO9, Position indicator output will reflect the new floor position.

c. Further activation of STU/STD will be ignored until after DZ is cycled (on/off), "re-arming" the electronic selector for stepping at the next floor.

3.4.3 Car Approaching a Stop at Floor

a. After the last STU/STD signal between the target floor and the previous to target floor, the P8 or PIO9, drops the H relay output, enabling the leveling sequence to occur.

b. As the car travels into the Door Zone area, it is driven into final stopping position by the LU and/or LD leveling sensors.

NOTE: The location for the STU, STD, and DZ signals location in the hoistway is proportional to the car's contract speed, please refer to the selector information provided as part of the job print package.

Section 4 – Final Adjustment

4.1 Door Adjustment

The elevator should be shut down and main power shut off.

a. Install door fuses F7 and F8.

b. Position the car in the hoistway so that car doors can be adjusted to a preliminary setting.

c. Open the doors by placing a jumper from the non-banded side of diode D73 (under the DO relay) to Terminal 3 on the controller and close doors by placing a jumper from the non-banded side of diode D65 under the DC relay to Terminal 3. Alternatively, place the car on inspection and follow door operation adjustment procedure described by the door operator manufacturer

✍ **NOTE**: Make sure jumpers on item c above are removed after door adjustment procedure is complete.

✍ **NOTE**: Most new solid-state door control systems offer adjustment procedures that require no interaction with the elevator controller.

4.2 Check Hoistway Clearances

The door operator must be operating properly with all door equipment clutches, rollers, etc., adjusted to correct running clearances. Make sure all hoistway and car doors in the building are closed and locked.

Run the car on inspection the entire length of the hoistway to be sure that the hoistway is completely clear of obstructions. Check to be sure that all selector vanes and the tape selector unit are properly installed per manufacturer's instructions.

4.3 Use of Test Switch

Turn the TEST switch to "Test" position, (the TEST switch is located on the HLS-7 board). Placing this switch in the test position prevents the controller from opening the doors (both front and rear if the car has rear doors) while car behaves as on Independent Service mode of operation.

Verify that all ribbon cable connectors, harness connectors, and relays are seated properly. Turn on AC power. Switch from inspection to normal operation. The car should travel to the bottom terminal landing, or re-position itself to the correct landing.

✍ **NOTE**: If this does not happen, jumper terminal 4 to DBC (door close button), place the control test switch in the "TEST" position. Observe the LCD liquid crystal display for Error Condition to determine why the elevator is not responding. Pay particular attention to the multiple LED indicators on the I/O-7 or PIO9 board.

If the car is leveling, the LVL indicator will be off, and the car will not be able to respond until the leveling process is complete. If any of the door opening devices or any call input is

active, the corresponding indicator will be lit. If the SD (or SU for up) indicator is on and the Down relay is not picked, check the normal limit switch. Also, check the DSD2 and USD2 LED's. They must not both be off, or reversed, as these are the corresponding terminal landing slowdown switches that open when the car is at each respective terminal landing.

Refer to Troubleshooting Section 7 of this manual for guidance.

4.4 Ez-LINK Serial Communication System Verification

CAUTION: Make sure the Serial Safety jumper has been removed from SH6 post terminals on HLS-7 board, if job is equipped with Ez-Link to top of car.

NOTE: For non Ez-LINK systems, skip to Section 4.5.

4.4.1 Verify Communication to TOC Board

To verify communication to the top of the car, LED's DIAG1 and DIAG2 on the TOC board should be blinking (approximately 4 times a second). DIAG1 indicates communication with the P8X or PIO9, board in the controller, and DIAG2 indicates communication with the COP board (or boards if rear doors are present). If the two diagnostic LED's are not blinking 4 times a second, verify wiring, and shielded communications wiring connections. Also, make sure all shields are correctly jumpered on all hoistway junction terminal strips.

4.4.2 Verify Communication to COP Board

To verify communication to the COP board, LED's DIAG1 and DIAG2 on the COP board should be blinking (approximately 4 times a second). DIAG1 and DIAG2 indicate communication with the TOC board on top of the elevator cab. If the two diagnostic LED's are not blinking 4 times a second, verify wiring. Perform this same check for the rear COP board, if present.

4.4.3 Verify Communication from COP to TOC Boards

Verify all signals coming from the COP and TOC boards to the P8 or PIO9, elevator microprocessor board. Refer to the Field Reprogramming Manual "Direct Access" menu. To view the following table, have someone go inside the elevator cab and press each car call and activate each button, while a second person selects and verifies proper activation response in the P8 or PIO9, memory map below:

NOTE: Verify that all job-required signals activate the proper input memory location in the P8 or PIO9 computer, per the table below, before removing the car from Inspection operation. Table Fig 4.1 lists all possible signals. You need only verify signals pertaining to your specific system.

To verify communications to the top of the car, LED's DIAG1 and DIAG2, on the TOC board should be blinking approximately 4 times a second. DIAG1 indicates communication with the P8X or PIO9, board in the controller, and DIAG2 indicates communication with COP board (or boards if front and rear doors are present).
If either of the two diagnostics LED's are not blinking approximately 4 times a second, verify wiring and communication shield connections. Also, make sure all shields are correctly jumpered on all hoistway junction terminal strips.

Figure 4.4 – Ez-LINK Memory Input Map

Address	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
F900	U8R	U7R	U6R	U5R	U4R	U3R	U2R	U1R	UCIR: Up call input rear
F901	U16R	U15R	U14R	U13R	U12R	U11R	U10R	U9R	
F902	U24R	U23R	U22R	U21R	U20R	U19R	U18R	U17R	
F903	U32R	U31R	U30R	U29R	U28R	U27R	U26R	U25R	
F904	U40R	U39R	U38R	U37R	U36R	U35R	U34R	U33R	
F905	U48R	U47R	U46R	U45R	U44R	U43R	U42R	U41R	
F906	U56R	U55R	U54R	U53R	U52R	U51R	U50R	U49R	
F907	U64R	U63R	U62R	U61R	U60R	U59R	U58R	U57R	
F908	D8R	D7R	D6R	D5R	D4R	D3R	D2R	D1R	DCIR: Down call input rear
F909	D16R	D15R	D14R	D13R	D12R	D11R	D10R	D9R	
F90A	D24R	D23R	D22R	D21R	D20R	D19R	D18R	D17R	
F90B	D32R	D31R	D30R	D29R	D28R	D27R	D26R	D25R	
F90C	D40R	D39R	D38R	D37R	D36R	D35R	D34R	D33R	
F90D	D48R	D47R	D46R	D45R	D44R	D43R	D42R	D41R	
F90E	D56R	D55R	D54R	D53R	D52R	D51R	D50R	D49R	
F90F	D64R	D63R	D62R	D61R	D60R	D59R	D58R	D57R	
F910	U8F	U7F	U6F	U5F	U4F	U3F	U2F	U1F	UCIF: Up call input front
F911	U16F	U15F	U14F	U13F	U12F	U11F	U10F	U9F	
F912	U24F	U23F	U22F	U21F	U20F	U19F	U18	U17F	
F913	U32F	U31F	U30F	U29F	U28F	U27F	U26F	U25F	
F914	U40F	U39F	U38F	U37F	U36F	U35F	U34F	U33F	
F915	U48F	U47F	U46F	U45F	U44F	U43F	U42F	U41F	
F916	U56F	U55F	U54F	U53F	U52F	U51F	U50F	U49F	
F917	U64F	U63F	U62F	U61F	U60F	U59F	U58F	U57F	
F918	D8F	D7F	D6F	D5F	D4F	D3F	D2F	D1F	DCIF: Down call input front
F919	D16F	D15F	D14F	D13F	D12F	D11F	D10F	D9F	
F91A	D24F	D23F	D22F	D21F	D20F	D19F	D18F	D17F	
F91B	D32F	D31F	D30F	D29F	D28F	D27F	D26F	D25F	
F91C	D40F	D39F	D38F	D37F	D36F	D35F	D34F	D33F	
F91D	D48F	D47F	D46F	D45F	D44F	D43F	D42F	D41F	
F91E	D56F	D55F	D54F	D53F	D52F	D51F	D50F	D49F	
F91F	D64F	D63F	D62F	D61F	D60F	D59F	D58F	D57F	
F920	DOLF	DBCF	DOBF	LLI	SEF	PHEF	DHLDF	DCLF	Front door inputs
F921	DOLR	DBCR	DOBR	DHLDR	HLI	SER	PHER	DCLR	Rear Door Inputs
F922	FCS	CLLI	IND	PGI	CCCI	copRc	copFc	tocC	Fire and Misc. inputs
F923	RD	PR	R32	R16	R8	R4	R2	R1	Absolute floor position
F924	Analog load weigher 16 bit value (future)								Used if analog load weighing device is used
F925									
F926	CF8	CF7	CF6	CF5	CF4	CF3	CF2	CF1	Car calls front floors 1 to 8
F927	CR8	CR7	CR6	CR5	CR4	CR3	CR2	CR1	Car calls rear floors 1 to 8
F928	FREE	FREE	FREE	p8xC	hallC	auxIr	auxIf	emtP2in	
F929	C16F	C15F	C14F	C13F	C12F	C11F	C10F	C9F	ACCIF: Front car call input
F92A	C24F	C23F	C22F	C21F	C20F	C19F	C18F	C17F	
F92B	C32F	C31F	C30F	C29F	C28F	C27F	C26F	C25F	
F92C	C40F	C39F	C38F	C37F	C36F	C35F	C34F	C33F	
F92D	C48F	C47F	C46F	C45F	C44F	C43F	C42F	C41F	
F92E	C56F	C55F	C54F	C53F	C52F	C51F	C50F	C49F	
F92F	C64F	C63F	C62F	C61F	C60F	C59F	C58F	C57F	
F930	C16R	C15R	C14R	C13R	C12R	C11R	C10R	C9R	ACCIR: Rear car call input
F931	C24R	C23R	C22R	C21R	C20R	C19R	C18R	C17R	

Ez-LINK Memory Input Map Continues

F932	C32R	C31R	C30R	C29R	C28R	C27R	C26R	C25R	
F933	C40R	C39R	C38R	C37R	C36R	C35R	C34R	C33R	
F934	C48R	C47R	C46R	C45R	C44R	C43R	C42R	C41R	
F935	C56R	C55R	C54R	C53R	C52R	C51R	C50R	C49R	
F936	C64R	C63R	C62R	C61R	C60R	C59R	C58R	C57R	
F937	FREE	FREE	FREE	FREE	FREE	ATT	UP	DN	Attendant inputs

4.5 Running the Car on Test Mode

NOTE: When the test switch on the HLS board (located on the relay printed circuit board) is in the "TEST" position, the doors will not open when the car arrives at a floor.

NOTE: To place car calls from the machine room for a standard non Ez-LINK systems, jumper from the IO-7 Call GND post, located on the top right corner of the board, to the car call field terminals on the IO-7 or IO-EX boards for standard controllers or from Terminal 3 to the car call field terminals on the PIO9 or IO-EX boards for Prodigy controllers.

P8 or PIO9 with car program version V5.50 or latter, use the Reprogramming Manual to locate the car call entry menu by raising all four menu switches and pressing the **UP** or **DN** (down) buttons to display **System Control**. Lower the Menu / Sub switch to enter the System Control menu and press the **UP** button until **EZ Link Advance** is displayed. Lower the View / Edit switch to enter direction and floor data.

Procedure

- Place the car on test mode.
- Set the left LCD character to 1 to move the car up or 0 to move the car down by pressing the **UP** or **DN** buttons.
- Press the shift button **SHIFT** to move between characters.
- Set the right LCD character to the number of floors from the current position to move the car by pressing the **UP** or **DN** buttons. A valid floor offset entry is 1 to 9 where 1 will command a 1 floor run, and 3 will command a 3 floor run, etc.
- Press the write button **WR** to start. Keep pressing the write button each time the car arrives at a floor to continue moving the car up or down by the same number of floors.

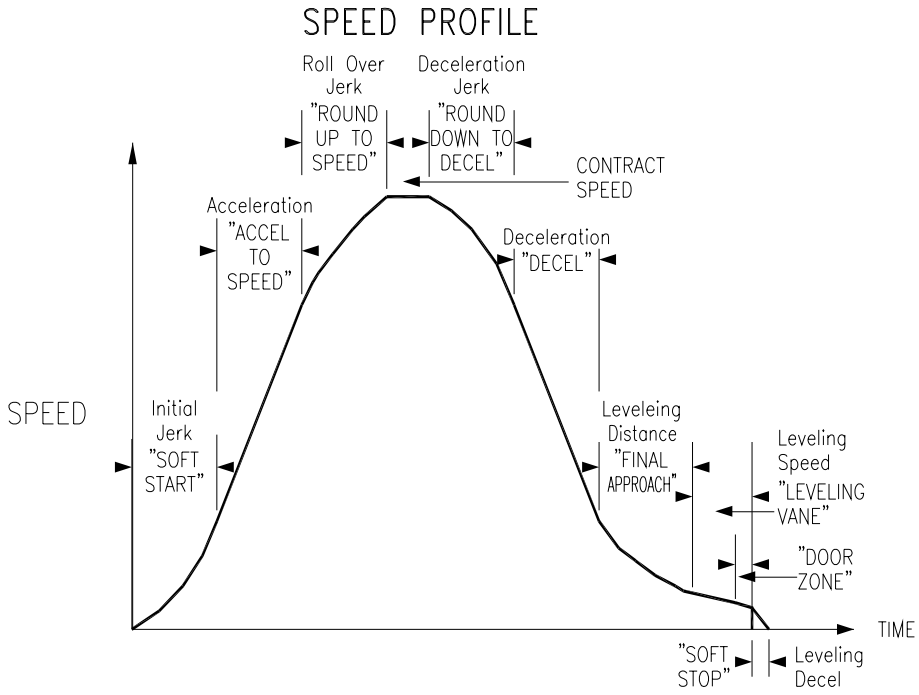
.

If a car traveling in either direction fails to reach the call within a pre-determined interval, the controller will identify this occurrence as a fault condition and automatically stop the car. Further operation of the elevator will be prevented until the fault condition has been cleared. To reset this fault, momentarily place the car on Inspection mode.

4.6 Speed Profile Adjustment

The speed profile reference drawing, Figure 4.6.1 below illustrates the area of impact for each of the parameters available for adjusting the elevator ride.

Figure 4.6.1 – Speed Profile



✍ **NOTE**: Observing the pattern output signal from the drive can save a lot of time and hassle. The best way to accomplish this is with a storage oscilloscope.

Figure 4.6.2 below illustrates the parameters available for adjusting the elevator ride per drive as well as the terminals at which the pattern speed profile can be observed.

Figure 4.6.2 – Speed Profile Rounding Parameters

Drive Type	Soft Start	Acceleration to Speed	Round Up to Speed	Round Down to Deceleration	Deceleration	Final Approach	Leveling Speed	Soft Stop	Inspection Speed
Yaskawa F7	C2-01	C1-01	C2-O2	C2-03	C1-02	C2-04	D1-02	C1-04	D1-05
Magnetek HPV-900	Jerk Rate 0	Accel Rate 0	Jerk Rate 0	Jerk Rate 0	Decel Rate 0	Lev Jerk Rate 0	Speed Command 2	Decel Rate 1 Lev Jerk 1	Speed Command 4
KEB Combivert F5	LF.50 Starting Jerk	LF.51 Acceleration	LF.52 Round to constant Speed Jerk	LF.53 Deceleration Jerk	LF.54 Deceleration	LF.55 Decelerati on jerk	LF.41 Leveling Speed	LF.56 Deceleration jerk	LF.42 Intermediat e Speed
Magnetek HPV-600	Jerk Rate 0	Accel Rate 0	Jerk Rate 0	Jerk Rate 0	Decel Rate 0	Lev Jerk Rate 0	Speed Command 2	Decel Rate 1 Lev Jerk 1	Speed Command 4
Magnetek DSD-412	Accel #1 %S Function 175	Accel # 1 Function 170	Accel #1 %S Function 175	Accel #1 %S Function 175	Decel # 1 Function 172	Decel #1 %S Function 175	Speed command 1 Function 151	Decel # 2 function 173, Decel #2 %S Function 177	Speed command 4 Function 156

To observe the Speed Pattern connect the oscilloscope to the drive Pattern Speed output to terminals indicated on Fig 4.6.2. A signal reference of +10 to –10volt output is expected.

CAUTION: If the grounding pin on your oscilloscope plug is electrically connected to the negative probe lead, then you MUST NOT attempt to connect the negative lead to the equipment or damage will occur. In this case, if your scope has 2-channels with channel B invert feature active, remove negative leads from probes, then press the A+B button on the scope. Use A and B probes to measure signal.

NOTE: After the speed pattern is adjusted as well as possible from the machine room, the adjuster should ride the car. A pair of hand-held radios and a helper can simplify this process, enabling the helper to adjust the system per the adjuster's instructions from inside the car. There is simply no substitute for adjusting while riding the car.

With the car on Inspection, bring the car to the bottom floor. Remove the car from Inspection, leaving it on Test mode of operation. Place a car call for one floor above. The car should make a one floor run up from the first level and slowdown into the second floor. Observe how the system responds, especially the brake, motor and sheave. Make any necessary adjustments to the mechanical portion of the system. Problems with the brake or door clutch clearances will become apparent here. Correct any problems as they occur before continuing with this adjustment.

With the car on Test mode, make single and multiple floor runs, adjusting speed profile parameters as necessary to "mold" the speed curve. You will need to make a sufficient number of runs to be sure that the system responds as desired. Take your time; adjustment procedures are not inherently quick, refer to Figures 4.6.1 and 4.6.2 and the oscilloscope speed output image to help make the necessary adjustments to the Speed Curve for maximum performance and ride comfort.

It is recommended that a series of test runs starting with one floor runs and then advancing to multiple floors runs up and down. If car vibration is detected, first check the encoder mounting and wiring. If mounting is solid and wiring is correct, adjust the drive response parameters as required, referring to Section 3.2.8 entry x.2.2 of this manual.

CAUTION: Higher drive gain numbers may cause oscillation, while lower numbers may cause sluggish response. Adjust these settings for optimal ride quality.

If the car will not move, refer to Section 7 of this manual for troubleshooting guidance. Note any error messages on the system LCD display. Look up these message/s on Tables 7.2, 7.3 and/or 7.4, which describe problems and possible solution/s.

Pay particular attention to the multiple LED indicators on the I/O-7 or PIO9 board. If car is leveling, the LVL indicator will be off, and the car will not respond until the leveling process is complete. If none of the door opening devices or calls inputs is active, the corresponding indicator will be lit. If the SD (or SU for up) indicator is on and the Down relay is not picked, check the corresponding normal limit switch.

Also, check the DSD2 and USD2 LED's. They must not both be off, or reversed, as these are the corresponding terminal landing slowdown switches that open when the car is at each respective terminal landing. Note any messages on the on the elevator computer board LCD display.

4.7 Final Ride Adjustment (Read thoroughly before continuing)

4.7.1 Brake Tension and Drive Response Setup

With the car at the bottom landing, put the car on inspection and test weights equal to two-thirds of contract capacity in the car.

Next, start adding weights in 50 or 100 pounds increments, moving car on inspection UP and DN after each increase. Continue until the car is loaded to 125% of contract capacity.

Test brake tension to stop and hold 125% of a contract load by tripping any stop switch except car stop switch open while the car is running down on inspection. Hold the "DOWN" button in while you trip open the stop switch (preferably on the inspection station). The brake should stop the car.

Next, with the car still loaded at 125% of contract load, set Inspection speed = Leveling speed (approximately 4 FPM using parameter indicated on Fig. 4.6.2 above, Inspection Speed) and verify that the car lifts and lowers (moves both up and down the hoistway with this load) at approximately the same speed. If the car does not move in the up direction, increase the drive gain as needed, referring to Section 3.2.8 entry x.2.2 of this manual.

Finally, return inspection speed to the desired value once the procedure in this section is completed.

4.7.2 Contact Speed Calibration

Refer to Section 3.2.8 entry x.2.3 of this manual for this step.

4.7.3 Adjusting Speed Pattern and Performance

Adjusting the speed pattern can be more of an art than a science. You have two goals: ride comfort and brake-to-brake time. You will have to decide which to work on at any one time. The two goals are not exclusive; both can be achieved. The sections below provide the adjuster with information and hints to help fine-tune the elevator for best performance and comfort. Please read thoroughly, making adjustments as needed.
As you adjust the parameters described below, refer to the relevant sections in the Drive Manual.

4.7.4 Decreasing Brake-to-Brake Time

a. Decrease Acceleration "Acceleration to speed" time.

NOTE: When you do this, you will probably have to Decrease Initial Jerk "Soft Start" and Roll Over Jerk "Round up to speed."

b. Decrease Initial Jerk "Soft Start" and Roll Over Jerk "Round up to speed" times.

c. Decrease Decel "Deceleration" time.

4.7.5 Improving Passenger Comfort

a. Decrease "Leveling Speed".

NOTE: Leveling speed is typically set high at the factory, so the car will not stall coming into a floor. In most applications, leveling speed will need to be decreased, to about 4 to 6 FPM, in order to eliminate any bump felt when stopping.

c. Increase Initial Jerk "Soft Start" time.

NOTE: Excessively high jerk values can cause passenger discomfort.

NOTE: Some motors cannot follow high jerk values. The resulting overshoot can cause bumps during the ride. A storage oscilloscope can be used to determine whether the motor is the limiting factor. Connect the probe to Speed Output the from the drive, then increase the initial jerk setting until a smooth start can be seen when looking at the speed output from the drive.

d. Increase Roll Over Jerk "Round down to Decel" time.

e. Increase Deceleration "Decel" time.

NOTE: Excessively "Deceleration" values can cause passenger discomfort and can also cause the car to overshoot the floor.

Adjustment should now be completed. Verify and correct proper floor leveling, and make sure door zone sensors are adjusted to prevent door pre-opening beyond +/- 2" from floor level.

CAUTION: Verify that all connectors in the system are correctly seated, if you have not done so before. Ribbon and pluggable field wire connector can wiggle loose

while the system is being worked on. Press firmly on all connectors to ensure that they are seated securely.

4.7.7 Landing System Vanes

Verify placement and operation of selector magnets or vanes and switches in the hoistway for proper stepping. Adjust valves for proper operation, verify the operation of all call buttons, and verify all functions including fire service main, alternate, and phase 2; independent service, access operation, etc. and verify car and door devices and switches; terminal slowdown, Up and Down normal limit switches, and all safety switches. Verify proper floor leveling and correct any problems.

4.8 Motor Limit Timer Control

If the car is traveling in either direction and fails to reach the call within a pre-determined time interval, the controller will identify this occurrence as a fault condition and automatically stop the car. To reset a motor limit timer fault, cycle the inspection switch or cycle the power disconnect.

LED indicators will show the computer error code while the LCD display will indicate the corresponding error status. The motor limit timer is factory preset for 180 seconds. Refer to the Model V900/H900 Field Reprogramming Manual for timer adjustment instructions.

4.9 Multiple Door Open Times

The V900 Non-PVF controller is equipped with selective door timing for car, hall, and short door open times. The factory-preset values are field adjustable using the onboard diagnostics unit. Refer to the Field Reprogramming Manual for complete details. Check door open times for proper operation conforming to ADA and other applicable codes.

NOTE: The hall door timer starts as soon as the car engages DZ, even if it is still leveling. If the pre-opening option is not set, doors may not finish opening before the hall door timer expires. If this happens, because the car takes too long to finish leveling into the floor, extend the hall door timer value to allow for the extra leveling time required.

Section 5 – LSSM-5 Adjustment

5.1 LSSM-5 Functional Description

The LSSM-5 or Low Speed Safety Monitor board is an independent means for monitoring elevator safeties and performance. In case of an elevator speed malfunction, the LSSM-5 will latch, preventing movement of the elevator until board latching circuits are reset by pressing the RESET button on the board.

Movement of the elevator is prevented by removing power from the ST relay coil, which in turns prevents the AA relay from closing which prevents the Delta starter from energizing.

The ST relay is also monitored to confirm proper operation before car motion is enabled.

NOTE: The Low Speed Safety Monitor (LSSM-5) contains several circuits required by ASME-17.1A/ASME A17.1 code, as well as other safety circuits. Therefore, it should be adjusted with care to ensure the integrity of the safety monitoring system.

The LSSM-5 system monitors:

a. Elevator overspeed
b. LSSM tachometer monitor
c. Leveling and inspection overspeed
d. Terminal slowdown monitor
e. Runaway elevator condition.

CAUTION: The following adjustments should not be attempted until final adjustment of the car is complete. If these adjustments are made prematurely, this procedure will have to be repeated after final adjustment.

CAUTION: TP-8 is ground. All measurements are to be made with the negative meter lead attached to TP-8. Do not use any other ground point for this purpose. If an oscilloscope is used, be certain that the ground lead is isolated from the line or board damage will result.

CAUTION: Verify that jumper SH2 on the LSSM-5 board has been removed. Be sure to **REPLACE THE SH2 JUMPER** once adjustment is completed. The SH1 jumper enables an external reset input to the LSSM-5 board. If this option is not currently being used, be sure the SH1 is not loaded.

NOTE: Section 5.2 is for Pulse Input feedback and Section 5.3 is for Tachometer feedback. Proceed to the appropriate section.

5.2 Setup Utilizing Pulse Input

Place the SH3 jumper on the LSSM board in the “FREQ” position. Place the “TEST” switch on the HLS-7 (relay) board in the TEST position these will disable door open operation and hall calls. Make a multi-floor run so that the car achieves contract speed. Measure and record the **highest** voltage on test post TP-6 with respect to test post TP-8 on the LSSM-5 board.

✍ **NOTE**: Skip to Section 5.4 to continue LSSM-5 adjustment.

5.3 Setup Utilizing Tachometer Input

Place the SH3 jumper on the LSSM-5 board in the “VOLTAGE” position and confirm that resistor R45 is installed. Place the “TEST” switch on the HLS (relay) board in the TEST position these will disable door open operation and hall calls. Make a multi-floor run so that the car achieves contract speed while adjusting Tach Gain potentiometer so that the voltage on terminal TP-6 with respect to terminal TP-8 on the LSSM-5 board is 8 volts.

5.4 LSSM-5 Adjustment Procedures

5.4.1 Overspeed

Set the overspeed potentiometer by running the car at contract speed and turning the "OVERSPEED" potentiometer counter-clockwise until the board indicates an overspeed trip. The "OVERSPEED" and the "SAFETY TRIPPED" LED’s should be lit. This procedure verifies that the overspeed circuit is working.

Multiply the tach voltage, recorded from Section 5.2, or the 8 volts setting from Section 5.3 above, by 1.15. Set the "OVERSPEED" potentiometer so that this voltage is read between TP-3 and TP-8. This procedure sets the overspeed trip point to 115% of maximum normal speed.

5.4.2.1 Tach Loss

Set the Motor Drive unit to activate the output tied to the LSSM board's "ABS" input at 10% of contract speed, refer to section 3.2.8 section x2.2.6 Digital Outputs for parameter setting. While making one floor runs, slowly turn the "TACH LOSS" potentiometer clockwise until the board indicates a tach loss trip. This verifies that the LSSM tach loss circuit is working.

Multiply the voltage recorded from 5.2, or the 8 volts setting from Section 5.3 above by 0.03. Set the "TACH LOSS" potentiometer so that this voltage is read between TP-1 and TP-8. Make several runs to verify that no tach loss tripping occurs.

If it does occur turn "TACH LOSS" potentiometer counter clockwise by one eight of a turn at a time while incrementing the motor drive unit “AS” output setting by 5% at the time, refer to Section 3.8 of this manual for “AS” parameter number direction. Call elevator Controls if condition persists after four increment steps.

Leveling & Inspection Overspeed

Set the leveling and inspection potentiometer with the car on inspection. While running the car, turn the "LEV/INSP" potentiometer counter-clockwise until the board indicates leveling and inspection trips. The "LEV/INSP" and the "SAFETY TRIPPED" LED's should be lit. This verifies that the leveling and inspection overspeed circuit is working.

Multiply the voltage from 5.2 or the 8 volts setting from Section 5.3 above by 140 then divide this number by the contract speed of the elevator in feet per minute. This is the recommended tach voltage at 140 fpm. Set the "LEV/INSP" potentiometer so that this voltage is read between TP-4 and TP-8. This sets the leveling and inspection speed trip point to 140 fpm.

EXAMPLE: Contract speed = 400 fpm
Tach Voltage @ contract speed = 5.00 V
5.00 X 140 = 700; 700 / 400 = 1.75 (the answer)
Set the voltage between terminals TP-4 and TP-8 to 1.75 V

5.4.2.2 Terminal Slowdown

Verify from controller prints if the "SLDN" terminal on the LSSM board is tied to the 4A bus. If it is, skip this adjustment.

Otherwise, while making multi-floor runs into either of the terminal landings, turn the "SLOWDOWN" potentiometer counter-clockwise until the board indicates a slowdown trip as the car slows down approaching the terminal. Now turn the potentiometer clockwise, a half turn at a time, until no trip is indicated on terminal slowdown.

Measure the voltage between terminals TP-2 and TP-8. Turn the "SLOWDOWN" potentiometer until it rises 0.1 V.

EXAMPLE: If the 'non-tripping' voltage at TP-2 is 6.50 V, set it to 6.60 V. Then make multi-floor runs into both terminal landings to confirm that the board does not indicate a slowdown trip. If a trip is detected, increase the voltage at between terminals TP-2 and TP-8 in 0.1 V steps until no trip is indicated. Finally, check to see that the voltage setting between terminals TP-2 and TP-8 is less than or equal to the voltage recorded from 5.2 or the 8 volts setting from Section 5.3 above.

5.4.3 Runaway

This function is not presently being used. Verify the potentiometer setting to 20 turns clockwise, producing 11 volts between terminals TP-9 and TP-8.

NOTE: Reinstall jumper SH2 on the LSSM-5 board. Adjustment in this section is now complete.

NOTE: The LSSM-5 board has two fault indications. If a momentary fault occurs the associated LED will illuminate and stay lit as a warning. The safety circuit will not open unless a fault is maintained for at least 0.4 seconds, which will be indicated by illumination of the Safety Trip LED.

Section 6 – Elevator Safety Tests & Inspection

6.1 Performing Elevator Safety Tests & Inspections

NOTE: The following procedure is intended as a guide while performing periodic inspection and safety tests of the elevator system. Please refer to the Safety Code for Elevators and all applicable local codes for specific requirements.

WARNING: Safety tests should be performed by a qualified adjuster or service personnel. A helper should always be present and prepared to turn off the main line disconnect to remove power from the elevator if needed **when the car is run with safety switches bypassed**. Proceed with caution.

NOTE: For the following safety tests, 6.2 thru 6.5, remove the wire from terminal RD, if absolute floor position is provided on the elevator controller, or program FC86 bit 1 to 0 (if the controller is equipped with Ez-LINK serial communication). Refer to the Model V900/H900 V5.x Field Reprogramming Manual, "Direct Access" operation, to disable the Absolute Floor Encoding option if it is being used. **RECONNECT THE WIRE REMOVED FROM TERMINAL RD OR PROGRAM FC86 BIT 1 TO 1 WHEN SAFETY TESTS ARE COMPLETED.**

6.2 Car Buffer Test – Fully Loaded Car

a. Place a full load in the car; place the controller test switch in the test position.

b. Enter a call to a floor several floors up from the bottom landing (but not to the top floor).

c. Jumper terminal 4A to all down slowdown switches terminals 34 and 35, and (DSD1, DSD2), to bypass all present down slowdown switches as required.

d. Identify and remove signal wire STD from controller terminal 72.

e. Place a jumper from controller terminals 17 to 23 to bypass safety switches. Place a jumper from controller terminals 29 to 33 to bypass the down normal limit switch.

f. Enter a car call to the bottom floor to run car into the buffer. After the car strikes the buffer, and drive sheave slips under the cables, quickly flip the controller inspection switch to the inspection position to stop the car. Run the car up to the bottom landing door zone area and **REMOVE ALL JUMPERS PLACED IN THE PROCEDURE DESCRIBED ABOVE AND WIRE STD SIGNAL BACK TO CONTROLLER**.

6.3 Counterweight Buffer Test – Empty Car

a. Place the controller test switch in the test position in test position.

a. Enter a call to a floor several floors below the top landing (but not to the bottom floor).

b. Jumper terminal 4A to all up slowdown switches terminals 31 and 32 (USD1, USD2), to bypass all present up slowdown switches as required.

c. Identify and remove signal wire STU from controller terminal 71.

d. Place a jumper from controller terminals 17 to 23 to bypass safety switches. Place a jumper from controller terminals 28 to 30 to bypass the up normal limit.

g. Enter a car call to the top landing to run the counterweight into the buffer. After the counterweight strikes the buffer, and drive the sheave slips under the cables, quickly flip the controller inspection switch to the inspection position to stop the car. Run car down to the top landing door zone area and **REMOVE ALL JUMPERS PLACED IN THE PROCEDURE DESCRIBED ABOVE AND WIRE STU SIGNAL BACK TO CONTROLLER**.

6.4 Governor & Rope Brake Test (ASME A17.1-2000 Section 2.19.1)

a. Place a jumper from controller terminals 17 to 23 to bypass safety switches.

b. Manually trip the governor overspeed switch and verify that the following events occur: GTS and GTSX relays drop out; the Emergency Brake or "Rope Gripper" sets; the GTSM LED monitor is illuminated; and the P8 or PIO9 board displays a Governor Contact Fault.

c. Lift the governor cable off the governor, and then spin the governor while measuring its speed to verify electrical and mechanical tripping speeds. A variable speed drill motor is a good method for spinning the governor.

d. Replace the governor cable and return the governor overspeed switch to the normal position.

e. Repeat procedure 6.4.c for a counterweight governor, if any.

f. **REMOVE JUMPER** between terminals 17 and 23**,** and verify that the SAF input LED on IO-7 or PIO9 is not lit.

g. Press the "ANSI-RST" button on HLS-7 board. The Rope Brake and the GTS and GTSX relays should pick, the GTSM LED monitor should be off, and the SAF LED should be on.

6.5 Safety Overspeed Test – Fully Loaded Car

a. Put a full load in the car then place the controller test switch in the test position.

b. Enter a call to the top floor.

c. Place a jumper from controller terminals 17 to 23 to bypass safety switches. Place a jumper between terminals 4A and GOV to bypass the governor.

d. Set the required parameters to run the motor at 1.4 times the contract speed (refer to Section 3.2.8 entry x.3 of this manual). Return the car to the top landing door zone area and return the inspection switch to the normal position.

e. Enter a car call to the bottom landing after preparing to measure car speed at the trip point. The car will accelerate to overspeed at which time the safeties will set firmly. Immediately flip the controller inspection switch to the inspection position to stop the car. Restore the car safety contacts to normal and the governor contact to normal.

Return the parameter for motor speed to its original value. **REMOVE JUMPER** between terminals 4A and GOV.

f. Repeat the procedure described in this section for a counterweight safety test, if required causing an empty car to overspeed from the bottom landing up.

g. **REMOVE JUMPER** from terminals 17 to 23.

NOTE: The LSSM-5 board and/or the motor drive may open the safety string after detecting the failure caused by the overspeed test above. Reset the LSSM-5 or Drive unit after the overspeed test is completed and the car is stopped to restore safety circuits to normal operation

6.6 Terminal Stopping Devices

6.6.1 Terminal Stopping Devices Test (ASME A17.1-2000, Section 2.25)

Down Direction:

a. Place the car on inspection, as the stopping devices function identically in both inspection and automatic operation.

b. Place a jumper from controller terminals 17 to 23 to bypass the safety switches.

c. Run the car down past the bottom landing. The car should stop when the down Normal Stopping Device (NTSD) contact is opened.

d. Run the car up. The car should move up, allowing the NTSD contact to close.

Up Direction:

a. Run the car up past the top landing. The car should stop when the up Normal Stopping Device (NTSD) contact is opened.

b. Run the car down. The car should move down, allowing the NTSD contact to close.

c. REMOVE JUMPER from terminals 17 to 23**.**

6.6.2 Final Terminal Stopping Device Test (ASME A17.1-2000, Section 2.25.3)

Down Direction:

a. Remove the jumper between controller terminals 17 and 23. Place a jumper from terminals 29 to 33 to bypass the down NTSD.

b. Run the car down, past the bottom landing. The car should stop when the Final Stopping device (FTSD) contact is opened.

c. Attempt to run the car. It should not move in either direction. Verify that the safety string is open by confirming 0 volts from terminal 23 to terminal 3.

d. Place a jumper between controller terminals 17 and 23.

e. Remove jumper from terminals 29 to 33. Verify that the NTSD is still open by confirming 0 volts from terminal 33 to terminal 3, and that the car will not move in the down direction.

f. Replace the jumper from controller terminals 29 to 33. Run the car down until the buffer is fully compressed. Verify that the FTSD remains actuated by removing the jumper from terminals 17 to 23 and confirming 0 volts on terminal 24 to terminal 3.

g. **REPLACE JUMPER** between terminals 17 and 23, and **REMOVE JUMPER** between terminals 29 and 33.

h. Move the car up to the bottom landing door zone area, then **REMOVE JUMPER** between terminals 29 and 33.

Up Direction:

a. Run the car to top landing.

g. Remove the jumper between controller terminals 17 and 23. Place a jumper from terminals 28 to 30 to bypass the down NTSD.

h. Run the car up, past the top landing. The car should stop when the Final Stopping device (FTSD) contact is opened.

i. Attempt to run the car. It should not move in either direction. Verify that the safety string is open by confirming 0 volts from terminal 23 to terminal 3.

j. Place a jumper between controller terminals 17 and 23.

k. Remove jumper from terminals 28 to 30. Verify that the NTSD is still open by confirming 0 volts from terminal 30 to terminal 3, and that the car will not move in the up direction.

l. Replace the jumper from controller terminals 28 to 30. Run the car up until the buffer is fully compressed. Verify that the FTSD remains actuated by removing the jumper from terminals 17 to 24 and confirming 0 volts from terminal 23 to terminal 3.

m. **REPLACE JUMPER** between terminals 17 and 23, then **REMOVE JUMPER** between terminals 28 and 30.

n. Move the car down to top landing door zone area and **REMOVE JUMPER** between terminals 17 to 23.

6.6.3 Emergency Terminal Stopping Test

✍ **NOTE**: This test procedure requires that the LSSM-5 monitor board has been adjusted per section 5 of this manual.

✍ **NOTE**: The LSSM-5 Slowdown input “SLDN” has been provided with Plug in jumper labeled D55 on the HLS-7 board to be used while performing this procedure, located towards the left center top of the HLS-7 board below the JLS harness connector.

To verify operation of the Terminal stopping perform following steps:

a. Place the car on Test mode of operation.

b. Place a car call to execute a multi floor run.

c. When the car reaches contract speed unplug the “D55” Plug in jumper, to simulate the opening of the NTSD device, The LSSM-5 board will trip with a Slowdown trip LED indication.

d. The car should come to a stop and no further car movement will be allowed.

e. Plug back in the “D55” Plug in jumper and verify the car will not be allowed to move.

f. Reset the LSSM-5 board to restore elevator service, repeat test for opposite direction.

6.7 Emergency Terminal Speed Limiting Device Test (ASME A17.1-2000, Section 2.25.4.1)

Down Direction:

a. Enter a call to a floor several floors above the bottom landing (but not to the top floor). Place a jumper from controller terminals 28 to 30 and 29 to 33 to disable the NTSD. Remove the SH2 jumper from the LSSM-5 board.

b. Place the controller inspection switch in the inspection position, and run the car one or more floors down to a lower floor level. Be sure DZ relay is picked.

c. Enter a car call to the bottom floor. As the car approaches the bottom landing, the DSD2 and DSD1 slowdown switches, in series with the High speed (H relay) and High Intermediate speed (HI relay if required by job), will open the circuit feeding the relays selecting the H and HI speed independently from the computer outputs. Verify that the car has stopped and that motor and brake contactors are not energized.

f. Verify that the car safeties have not been applied.

CAUTION: After completing safety tests, be sure to **REMOVE JUMPERS** above, and **REPLACE** the SH2 jumper on the LSSM-5 board.

Up Direction:

a. Enter a call to a floor several floors below the top landing (but not to the bottom floor). Place a jumper from controller terminals 28 to 30 and 29 to 33 to disable the NTSD. Remove the SH2 jumper from the LSSM-5 board.

b. Place the controller inspection switch in the inspection position, and run the car one or more floors up to an upper floor level. Be sure DZ relay is picked.

d. Enter a car call to the top floor. As the car approaches the top landing, the USD2 and USD1 slowdown switches, in series with the High speed (H relay) and High Intermediate speed (HI relay if required by job), will open the circuit feeding the relays selecting the H and HI speed independently from the computer outputs. Verify that the car has stopped and that motor and brake contactors are not energized.

c. Verify that the car safeties have not been applied.

CAUTION: After completing safety tests, be sure to **REMOVE JUMPERS** above, and **REPLACE** the SH2 jumper on the LSSM-5 board.

✍ **NOTE**: An Emergency Terminal Speed Limiting Device Test (ASME A17.1-2000, Section 2.25.4.2) is not required on elevators that have an emergency terminal speed limiting device that complies with ASME A17.1-2000 Section 2.25.4.1

✍ **NOTE**: **RECONNECT THE WIRE REMOVED FROM TERMINAL RD OR PROGRAM FC86 BIT 1 TO 1 WHEN SAFETY TESTS ARE COMPLETED**, if Absolute Floor Encoding is used.

6.8 Test Procedures for Monitoring Critical Circuits
(ASME 17.1-2000 Sections 2.29.9.3 and 2.26.9.4)

6.8.1 This Section Describes Test Procedures that Confirm Compliance with Part B, Redundancy & Monitoring in Critical Circuits
(ASME A17.1-2000, Sections 2.29.9.3 and 2.26.9.4)

✍ **NOTE**: All relays used as critical components are **Safety Relay SR6,** such relays are known as forced guided relays with the characteristics which allow the monitoring of one contact to be used to determine the state of the remaining relay contacts.

✍ **NOTE**: LCD refers to the P8 or PIO9 display unit for all tests below, unless otherwise specified

✍ **NOTE**: Make sure elevator is placed on TEST mode of operation and elevator cab has been evacuated before proceeding with testing procedure below.

6.8.1.1 Microprocessor Monitoring
Critical Component: P8 or PIO9 Microprocessor
Redundant Component: P8 or PIO9 and GTS watch dog timers
Monitored Component: Memory Checksum, I/O Integrity check

The P8 or PIO9 microprocessor board incorporates a watch dog timer which needs to be refreshed by the program loop every 0.25seconds, a second watch dog timer is used to time out the P8 or PIO9 main safety output for the GTS relay, therefore in the event that the computer were to malfunction the watch dog timer will perform a computer reset and in the event that the computer is not able to reset, the GTS watch dog timer will reset the GTS output, to disable the GTS relay and removing power to Starter coils and brake circuits.

GTS Watch dog timer test:
Press the reset button on the P8 or PIO9 and hold it down to prevent the computer from functioning. This will also prevent the onboard microprocessor timeout from updating the GTS timed output. As a result, GTS relay should drop resetting the GTS relay output opens the power circuit to the Starter coils.
Print reference to GTS and GTSX contacts 4 is page 1 area 1 of the prints.
To restore, release pressure on the reset button.

P8 or PIO9 Watch dog timer test:

Turn power off and remove program chip labeled L.Hex, turn power back on and observe the Power on LED on the P8 board blink at the rate of 0.25 seconds demonstrating the effect of the P8 or PIO9 watch dog timer, turn power off to restore program chip.

✍ **NOTE**: The P8 or PIO9 also performs a memory integrity check for by writing a pattern to the Ram memory and by performing check sums to the program portion of the software and comparing them to default stored values, if the program gets corrupted the computer will display a "Memory Corruption Error" and will disable all outputs.

P8 I/O Integrity Check (Standard controller only)
Turn power off and remove the ribbon cable that connects the P8 to the Monitor board, this should signal the computer that the computer I/O string to the monitor board has failed. The computer display should show, "Safety String Open," preventing the computer from executing any motion commands.
Restore the ribbon cable into its socket. Make sure socket latching hooks are latched.

✍ **NOTE**: The IO-EX-B44 circuits are part of the PIO9 board.

6.8.1.2 GTS & GTSX Relay Operation and Monitoring

Critical Component: GTS and GTSX Relays
Redundant Component: GTSM Computer Monitoring Input
Monitored Component: GTS and GTSX Relays contacts

Apply 110 VDC using a jumper from terminal 4A to R13 resistor, located above the HDR relay label, on HLS-7 board. The LCD should show, "GTS Relay Fault". GTS and GTSX relays should drop, Confirm that the car will not respond to hall or car calls. The latching fault should not clear until the ANSI-RST button is pressed.

6.8.1.3 Stop Relay Proper Operation and Monitoring

Critical Component: STOP Relay
Redundant Component: STOPM Computer Monitoring Input
Monitored Component: STOP Relay Contacts

Apply 110 VDC using a jumper from terminal 4A to harness connector JSDI-6, STOPM monitor input, located on the top left corner of the HLS-7 board. The LCD should show, "Stop Relay Fault." Confirm that the car will not respond to hall or car calls. **REMOVE JUMPER**. Car shall return to normal operation once jumper has been removed.

6.8.1.4 DZ Relay Proper Operation and Monitoring

Critical Component: DZ Relay
Redundant Component: DZM Computer Monitoring Input
Monitored Component: DZ Relay Contacts

On inspection move the car outside door zone area, remove field wire from terminal DZM on HLS-7 board, remove car from inspection. The LCD should show, "Door zone relay fault." Confirm that the car will not respond to hall or car calls. **Replace wire into DZM terminal** to return Car to normal operation.

6.8.1.5 Leveling Relay Operation and Monitoring

Critical Component: LVL Relay
Redundant Component: LVLM Computer Monitoring Input
Monitored Component: LVL Relay Contacts

Position the car below or above floor level using Controller Inspection mode, Short resistor R4 to terminal 4A, R4 is located on HLS-7 board below JUP ribbon cable connector. Turn Controller Inspection switch off. The LCD Display should show, "Level Relay Fault." Confirm that the car will not respond to hall or car calls. **REMOVE JUMPER**. Car shall return to normal operation once jumper has been removed and ANSI-Reset push button is pressed.

6.8.1.6 Car Gate Relay Operation and Monitoring

Critical Component: CG Relay
Redundant Component: DLM Computer Monitoring Input
Monitored Component: CG Relay contact.

With the car doors fully closed, DLK LED indicator on IO-7 or PIO9, DCLF LED indicator OFF, apply 110 VDC with a jumper from terminal 4A to SH47 jumper, located above HDR relay label, on HLS-7 board. The LCD should show, "Door Lock Relays Fault." Confirm that the car will not respond to hall or car calls. **REMOVE JUMPER** car shall return to normal operation once jumper has been removed.

6.8.1.7 Car Stop Bypass Relay Operation and Monitoring

Critical Component: CSB Relay
Redundant Component: CSBM Computer Monitoring Input
Monitored Component: CSB Relay contact.

With the car level at a floor, remove field wire from terminal 17B on the HLS-7 board, to remove power to CSBM computer input. The LCD should show, "Car stop bypass relay Fault" Confirm that the car will not respond to hall or car calls. Replace wire to terminal 17B to return car to normal operation.

6.8.1.8 Entry purposely left blank

6.8.1.9 Delta and BK2 Contactors, Motor and Brake Contactor Monitoring

Critical Component: AA Relay, Delta and BK2 contactors
Redundant Component: STPM Computer Monitoring Input
Monitored Component: AA relay, Delta and BK2 Auxiliary contacts.

With the car level at a floor, remove AA relay from its socket on the HLS-7 board, to remove power to STPM computer input. The LCD should show, "Contactor Drop relay Fault" Confirm that the car will not respond to hall or car calls. Replace AA relay Car shall return to normal operation once relay has been replaced. Repeat for Delta and BK2 contactors by manually pressing contactor instead of removing wiring from auxiliary contacts.

6.8.1.10 High Speed, Contactor Aux., Contactor Relays Operation and Monitoring

Critical Component: H, AA, Delta Relays

Redundant Component: STPM Computer Monitoring Input
Monitored Component: H, AA, Delta Aux. Relay contact.

With the car level at a floor, remove H relay from its socket on the HLS-7 board, to remove power to STPM computer input. The LCD should show, "Contactor Drop relay Fault" Confirm that the car will not respond to hall or car calls. Replace H relay Car shall return to normal operation once jumper has been removed. Repeat for AA relay and for Delta Auxiliary manually press contactor instead of removing wiring

6.8.1.11 High Speed HR Relay output Operation and Monitoring

Critical Component: H Relay
Redundant Component: USD2 and DSD2 Terminal Slowdowns and STU and STD stepping Signals, and Computer Monitoring Inputs.
Monitored Component: USD2 and DSD2 Terminal Slowdown switches.

USD2 and DSD2 inputs test:
Place car on test mode of operation and verify car runs to all floors and stops and levels into position without generating faults to verify all selector signals normal operation.
Move the car to an intermediate landing and remove field wire from terminal 32, verify computer will reset elevator position indicator to top floor, replace wire to terminal 32 and remove wire from terminal 35, verify computer will reset floor position indicator to bottom floor.

DSD2 test:
On Test mode of operation move the car away from bottom floor to another landing, then jump D31 anode to ground, this will pick up H (high speed relay) upon getting a command to run. Remove wire from terminal 72, STD signal preventing the computer from stepping the car down. Place a car call to the bottom floor; upon arrival to the bottom floor the car will slow down and will make a normal stop into the bottom floor.
Replace wire to terminal 72, remove jumper to D31 diode, and momentarily place car on inspection to clear out of step fault.

USD2 test:
On Test mode of operation move the car away from top floor to another landing, then jump D31 anode to ground, this will pick up H (high speed relay) upon getting a command to run. Remove wire from terminal 71, STU signal preventing the computer from stepping the car up. Place a car call to the top floor; upon arrival to the top floor the car will slow down and will make a normal stop into the top floor.
Replace wire to terminal 71, remove jumper to D31 diode, and momentarily place car on inspection to clear out of step fault.

6.8.1.12 LVLO Relay output Operation and Monitoring

Critical Component: LU and LD Selector signals
Redundant Component: LVLO Computer output & LVL relay.
Monitored Component: LU & LD, LVLM input.

Place car on test mode of operation and make several one and multi floor runs, observe that the LVLO output LED on IO-7 or PIO9 board and that the LVL Relay energizes only when the car comes into leveling zone of target floor independently of the LU and LD inputs. Please refer to test 4 above for LVL Relay test for LVL relay test.

6.8.1.13 DZ1 and DZ2 Selector signals Operation and Monitoring

Critical Component: DZ1 and DZ2 Selector signals
Redundant Component: DZI, DZM Computer inputs and DZ relay.
Monitored Component: DZ relay and DZI, DZM computer inputs.

Place car on test mode of operation and make several one and multi floor runs, observe that the DZ input t LED on IO-7 or PIO9 board come on and the DZM input goes off as the car passes over the trucking zone but the car continues to move in high speed only allowing leveling and door operation at the target floor. Refer to test 3 above for DZ relay test and unintended movement test below for further monitoring of the DZ1 and DZ2 inputs.

6.8.1.14 Hall & Car Door Bypass Switch Operation and Monitoring

Critical Component: Hall and Car Door Bypass Switches
Redundant Component: HDBM Computer Monitoring Input
Monitored Component: Hall and Car Door Bypass Switches Contacts

Jump R15 resistor top to ground, R15 is located above the STOP relay on HLS board. The LCD should show, "Door Bypass System Fault." Confirm that the car will not respond to hall or car calls. **REMOVE JUMPER**. Car shall return to normal operation once jumper has been removed

Place the car on Automatic Operation and open the hall and/or car doors, the DLK LED should be off. Turn on Car Door Bypass and/or Hall Door Bypass switch(s) as necessary. Verify that the controller mode of operation changes to Inspection.

On the controller relay board, flip the Inspection Switch to "INSP." Flip the run switch "Up" and then "Down" and confirm that the car will not run on inspection. Turn on Car Door Bypass and/or Hall Door Bypass switch(s) off, and press the ANSI-Reset push button to return car to normal operation.

✍ **NOTE**: If the hoistway door or car door is bypassed, the elevator controller will prevent the car from being run using the machine room inspection circuit or on access inspection mode, the car will only be allowed to move on Car Top Inspection mode of operation.

6.8.1.15 Detection of Jumpers on Door Safety String

Critical Component: Car Gate and Hoistway Door Locks
Redundant Component: CG Relay
Monitored Component: CG, THD, DLK and DCL Computer Monitoring Input

With the car on automatic operation, place a jumper from terminal 4 to CG on the HLS-7 board. Press the Door Open button and allow doors to fully open. The LCD should show, "Door lock system fault." Confirm that the car will not respond to hall or car calls. **REMOVE JUMPER**. Car shall return to normal operation once jumper has been removed.

With the car on Automatic Operation, place a jumper from terminal 4 to THD on the HLS-7 board. Press the Door Open button and allow doors to fully open. The LCD should show, "Door Lock System Fault." Confirm that the car will not respond to hall or car calls. **REMOVE JUMPER**. Car shall return to normal operation once jumper has been removed. Place the car on Inspection Mode and verify that the car will not respond to hall or car calls.

6.8.1.16 Door Open and Closed Simultaneously

Critical Component: Door Opened & Door Closed Limits
Redundant Component: DOL and DCL Computer Monitoring Inputs
Monitored Component: Door Opened & Door Closed Limits

Place a jumper from the Terminal DOB to terminal 4 on the IO-7 or PIO9 board and allow the doors to open fully. Confirm that the DOLF LED indicator on the IO-7 or PIO9 board is off, and remove the DCLF input wire from IO-7 or PIO9. The LCD should show, "Front Door Limit Switches Fault." Confirm that the car will not respond to hall or car calls. **REMOVE JUMPER** and reattach DCLF input wire to return car to normal operation.

6.8.1.17 Revert to Automatic Operation (ASME 2.26.9.3.d)

Critical Component: IN Computer Input, SU or SD Computer Outputs
Redundant Component: IN, and STOP relays
Monitored Component: INM, and STOPM Computer Monitoring Inputs

With the car on Inspection operation, place a jumper from D20 or D26 diode anodes on the HLS-7 board to terminal 3 "ground." These diodes are in series with the computer SU and SD direction relay outputs. Confirm that the car will not move and will not respond to any car or hall call demand.

REMOVE JUMPER. Return the car to Normal mode of operation.

6.8.1.18 Unintended Movement (ASME 2.19.2)

Critical Component: DZ, and LVL Relays
Redundant Component: DZ, and LVL Contacts
Monitored Component: DZM, LVLM, CG, and THD Computer Monitoring Inputs

Place a jumper from the Terminal DOBF to terminal 4 on the IO-7 or PIO9 board and allow the doors to open fully. Confirm that the DOLF LED indicator on the IO-7 or PIO9 board is off. Turn power off, remove wires from 27 and DZM terminals located on HLS-7 board. Restore power.

The LCD should show, "Unintended Movement System Fault." Relays GTS and GTSX should drop, setting the emergency brake and opening the directional circuits. Turn power off and rewire terminals 27 and DZM. Confirm that the error does not reset by cycling power. The latching fault should not clear until the ANSI-RST button is pressed.

6.8.1.19 Single Ground

Critical Component: N/A
Redundant Component: N/A
Monitored Component: N/A

Short terminal 4 located on the controller power terminal strip, (not on the any of the PC boards) to ground. Fuse F4 should blow removing power to all elevator control relay logic disabling all controller functions. Turn power off, and replace fuse.

6.8.1.20 Permit Car Speeds Over 150 fpm (ASME 2.26.9.3.c except 2.26.1.5.10(b))

Critical Component: LVL, STOP Relay, Motor Drive
Redundant Component: LSSM-5 Board, ST Relay
Monitored Component: LVL, STOP Relay Contacts

Place the car on Inspection operation. View the PVF parameters menu and select the inspection speed parameter. Write down the current inspection speed (so it can be restored later). Then increase inspection speed to150 fpm. Run the car on Inspection and verify that the LSSM-5 board trips on Leveling/ Inspection. It should produce a LEV/INSP fault. This prevents the ST relay from picking which in turn should prevent the AA relay from picking and the motor contactor from operating. Refer to Section 5, LSSM-5 in this manual for LSSM-5 adjustment.

Reset the LSSM-5 board and restore the inspection speed to the original setting.

Section 7 – Troubleshooting

7.1 System Not Functional in General (Car Won't Run)

✍ **NOTE**: The Solid State portion of the Elevator Controls Microprocessor Controller is the most reliable part of the entire elevator system. While it is possible that a problem may occur, one should first look to the power controller and "outside world" for the malfunctions that most frequently take elevators out of service.

✍ **NOTE:** Earthquake faults can only be cleared by placing car on controller Inspection operation, once earthquake switches and sensors have been reset, then returning the car to Normal operation.

7.1.2 General Troubleshooting Tips

For your convenience, and in order to save troubleshooting time, the V900 Non-PVF controller is equipped with multiple indicators that are designed to help you troubleshoot at a glance.

You are strongly advised to pay particular attention to the indicators on the I/O or PIO9 board. Every action instructed by the computer is indicated (DOF for example means door open function, the computer wants to open doors), and every action the human interface wants the computer to perform is also indicated (DOB for example means the door open button is active).

✍ **NOTE**: Signal names written with bar on top of the signal name, indicates the signal is in active mode when the LED is off ($\overline{\text{FRS}}$ and $\overline{\text{FRA}}$ are a good examples – when the LED is off they indicate the car is on main or alternate fire mode respectively).

The computer error code LED display will flash a particular status/error code as detected by the P8 or PIO9 computer; a list of these codes can be found permanently applied to the inside of the controller door. Extra or replacement copies can be made from the list found in the Field Reprogramming Manual.

Computer error/status codes are also displayed in English format on the LCD display. Finally, an optional PC may be used for powerful troubleshooting, diagnostics, and for monitoring purposes.

7.1.3 Car Not Running General Check List

a. Make sure that the car is not on Fire Emergency Service; The P8 or PIO9 will display the fire operation active if any. During normal operation of fire emergency circuits, 24-110V should be present on each fire recall terminal with respect to terminal 3, (refer to prints page 5 for fire interface circuits).

b. If all terminals for Fire Emergency Service are properly set, refer to Section 7.2.1 for directions to reset the different modes of Fire Emergency Service.

c. If the elevator is not set to Fire Emergency Service, all power supplies should then be checked. The natural starting point is the three-phase input. There must be 208-480 VAC (as specified) present between all combinations of phases.

d. Verify that each power control step-down transformer has the correct secondary voltage (refer to Controller Schematic page 1 for terminal and fuse numbers). Replace fuses as necessary.

e. Terminal 4A should measure approximately +110 VDC. The voltage at Terminal 50, (hall lamp supply) with reference to ground and the voltage between Terminal Strip terminals 1 and 2 should be measured and verified to be in accordance with the voltages shown on page 1 of the job prints. If any of the above power supply voltages are not within range, check the appropriate fuses.

✍ **NOTE**: System common is the 3 buss, (normally terminal 3 is connected to chassis ground), and unless otherwise noted all DC voltage measurements are with respect to Terminal 3 or chassis ground.

f. Verify the Safety String (schematic for it is located on the upper portion of page 3 of the job prints). The Safety String is made up of normally closed safety contacts and switches connecting Terminal 4A to Terminal 23. In order for the car to run, all of these contacts must be closed, which will cause +110 VDC to be applied to Terminal 23 signaling the computer input that the safety string is closed (SAF input is active, verify LED on IO-7 or PIO9).

g. Assuming Terminal 4 is operating properly at +110 VDC verify that the computer display does not show Safety String Open. If this message is displayed, check to be sure that the termination jumper plug has been correctly placed on the last IO or IO-EX board inside the Out ribbon cable connector.

h. Verifying that the GTS indicator located on the IO-7 or PIO9 is on, the following relays should also be on: GTS, GTSX, and STOP (STOP will be on for Automatic mode of operation and off for Inspection/ Access operation) CG, and once demand is establish, U or D (depending on intended direction). AA should be on, H relay will also pick if the slowdown for that direction of travel is closed and automatic mode of operation is selected.

✍ **NOTE**: All relays mentioned below on item “i” are located on the HLS-7 board.

i. Direction (SU/SD) and speed signal HR both enter the HLS-7 board from the computer relay driver outputs on the I/O-7 or PIO9 board via the connecting ribbon cable. Pin numbers are indicated on prints (pin one is indicated by a red conductor in the ribbon cable). If a high speed run toward a call is required, register a call and check the appropriate up or down arrow (SUA/SDA) LED. If neither arrow is on, make sure no special function has control of the car (INS in, INA out), and that the fire warning indicator (FWI) is off. If all the above functions are normal, call registration should establish a direction of travel as indicated by an arrow, which can be observed on the IO-7 top right corner or towards bottom left corner on the PIO9 LED indicator. If no arrow is displayed, refer to the Microprocessor Troubleshooting Section 7.6 following below.

j. Some of the relay coils referenced above are hardware interlocked through the door safety circuit. In order for the car to move away from a landing, all doors must be closed and locked. A locked condition is indicated by a lit DLK indicator on the I/O7 or PIO9 board (+11O VDC on Terminal 11). An unlocked condition leaves the DLK

indicator unlit (with 0 VDC on Terminal 11). Also the door closed limit switch should be open and the door open limit should be made, (verify 0 volts on terminal DCL and +110 VDC on terminal DOL). If the door string indicates an unlocked condition, examine and repair door locks as required.

k. Should the U or D relays remain unlatched with a properly locked door circuit, check the UP STOP LIMIT switch located between terminals 28 to 30, similarly terminals 29 to 33 for down. These switches are feeding power to the directional circuits. If switches are not made, the direction relays can not be energized by the microprocessor outputs. See page 3, area 4 of prints for stop limit switches and directional circuit functions.

7.2 Microprocessor Error Reporting and Correction

7.2.1 Elevator Normal Operation Fault Monitoring and Display

The table below shows the different faults that can be generated from the normal monitoring portion of the system as follows:

Scrolling Message: Indicates the display shown on the LCD display for each fault.

Description and Possible Solution: Explains how the fault was generated and possible corrective action to resolve the fault.

NOTE: Faults listed in Figure 7.*2* below will not prevent the car from starting or executing the function fault such as Fire Service, Independent Service, Etc. Faults listed in Figure 7.2 will prevent the car from running.

NOTE: A group of special conditions are recognized by the microprocessor. If one of these "errors" occurs, a code will be displayed corresponding to that condition. The microprocessor will scroll up to 6 errors at a time on the LCD display. The eight LED array will display the error that needs too be corrected first, that is, the one with the highest priority.

NOTE: The field technician should look first to the LED array to identify the error that needs to be corrected first. Error codes can be found in this Section (below) and on the inside of the control equipment enclosure door.

Figure 7.2 – Fault Conditions that will Not Prevent the Car from Running	
Scrolling Message	**Description and Possible Solution**
Main Fire Service Phase 1	Main floor smoke detectors or HF1 smoke detectors activated. Reset smoke detectors. **Return car to the fire floor and turn fire service switch to reset to clear fire service condition.**
Alternate Fire Service Phase 1	Alternate floor smoke detectors or HF2 smoke detectors activated. **Reset smoke detectors. Return car to the fire floor and turn fire service switch to reset to clear fire service condition.**
Fire Service Phase 2	Fire Service Phase II switch is on or was on before power down. **Return car to the fire floor and turn Fire Service Phase II switch to off position and open the doors to break door open limit to clear fire service condition.**
Front Doors Not Fully Closed	Front door closed limit not open, even do door lock is made.
Rear Doors Not Fully Closed	Rear door closed limit not open, even do door lock is made.
Leveling Down	Level Down input on
Leveling Up	Level Up input on
In leveling Zone Without Direction	Either level Up or Down input is active but direction of movement can't be achieved. **Verify Up and Down terminal switches probably one or both are open**.
Re-Leveling Down	Re-Leveling Down on after being level
Re-Leveling Up	Re-Leveling Up on after being level
Trying to Re-Level Without Direction, or Both Directions On	Either level Up or Down input become active after being level, but direction of movement can't be achieved. **Verify Up and Down terminal switches probably one or both are open.**
Doors Unlocked	Car at landing with the doors not locked, DLK input off.
Security mode in operation	BSI input is active, placing car in COP security operation, where the COP car call buttons are used to input access codes to place car calls.
Independent Service	IND input is active, placing car in independent mode of operation.

Fault Conditions that will Not Prevent the Car from Running (continued)	
Hospital Service	Car is responding to a hospital emergency request.
Independent and security mode	BSI and IND inputs are active simultaneously. **Remove one of the inputs; these two modes of operation contradict each other.**
Emergency power operation	Car is executing an emergency power return or operating under emergency power.
EMT phase 1 operation	EMT-1 input became active to request Massachusetts's Medical emergency recall.
EMT phase 2 operation	EMT-2 input became active to place the car on Mass. Medical emergency mode of operation.
Earthquake: Normal condition	EQI input become active and then went back to normal allowing the car to run on earthquake normal mode at 150ft/min maximum speed.
Earthquake: Abnormal condition	EQI and CWI inputs became active and stayed active, counter-weight derailed grounding both inputs, or CWI input is active only indicating that the string running in the hoistway tear down.
Heavy Load in Car	HLI input became active, placing car under heavy load operation thus bypassing hall calls until doors open and HLI input becomes in-active.
Controller Inspection	Car is under controller inspection mode of operation.
Access Inspection	Car is under access inspection mode of operation.
In-car inspection	Car is under in car inspection mode of operation.
Ca top inspection	Car is under car top inspection mode of operation.
Viscosity Control **Hydraulic Function only, disable function and remove label from IO terminal**	The microprocessor is running the pump motor while the VSI input is on to keep the motor oil viscosity under control. The pump will run for three minutes on and stop for nine minutes, and will continue this cycle until VSI input becomes inactive. **Call ECC for Support if Error Occurs in a Traction Elevator.**
Car on wild operation	Group - loss of communication or WILD operation is active. Function can be used for Sabbath operation.

Fault Conditions that will Not Prevent the Car from Running (continued)

Car door bounced during takeoff	The car took off on high speed run and the doors relaxed, opening the door lock safety string to terminal 11. **Make sure door close power while running jumper is on across terminals 43 to 44, where applicable, verify page 3 of prints and your door operator manufacturer for proper guidance.**
Door lock clipped open at high speed	The car was running on high speed while the door lock broke open. **Check door lock clearance.**
Hall or car lamp fuse blown	The computer is detecting all car or all hall call buttons active at the same time, which happens when the common to the lamps is not present. **Check fuses FLS or 50H, 50. Refer to page 1 of prints**.
Absolute PI correction	The computer internal selector track did not match the absolute floor encoding in the hoistway for the floor the car just arrived. **Remove RD signal and run the car with the internal selector tracking only, if car does not stop at the wrong landing verify the position feedback portion of the selector. If the car stops at the wrong floor verify the stepping portion of the selector.**
Door zone count error	Error display will occur when stepper tracking option is set to on, and is used to determine which selector signal may be missing in the hoistway causing the car to stop at the wrong floors. **Call Elevator Controls for more information about using this option for diagnostics.**
Door Zone Input Error	The car got the door zone input before engaging leveling, i.e. crash into a floor. Once error occurs it latches until microprocessor is reset or the car is momentarily placed on inspection to clear fault message. **Verify LU and LD work properly at each floor.**
Car out of Step	Missed door zone input or mechanical speed limit actuated before selector stepping input. This error is only detected while the car approaches a terminal landing. Once it occurs, it latches until the microprocessor is reset or the car is momentarily placed on inspection to clear fault message. **Correct position of Up and Down slowdown switches, need to activate 1 to 2 inches after STU or STD drop off. Verify and replace any DZ target on the selector if needed.**
Test mode	Test switch on, car will behave as in independent service but will inhibit door opening operation.

Fault Conditions that will Not Prevent the Car from Running (continued)	
Unknown Error	The computer detected an error that was not able to identify. **Place car on inspection, and reset the microprocessor. Call Elevator Controls if error persists.**
Password access active	Current password has been entered and system access granted.

Figure 7.3 – Fault Conditions that Will Prevent the Car from Running	
Scrolling Message	**Description and Possible Solution**
Safety String Open	Voltage is not getting to the microprocessor SAF input. **Check voltage on terminal 4A (110 VDC), and follow the safety string path to terminal 24. Refer to page 3 of job prints**.
USD2 & DSD2 on simultaneously	Both Up and Down Slowdown speed limits switches are open at same time. **One of the two or both limit switches failed repair or replace.**
Check channel A cable / termination	A cable on Channel A chain is not properly seated or the last board on the chain does not have the terminator jumper installed. **Re-seat cables, or add terminator to last IO board.**
Check channel B cable / termination	A cable on Channel B chain is not properly seated or the last board on the chain does not have the terminator jumper installed. **Re-seat cables, or add terminator to last IO board, only for P8 driven controllers.**
EEPROM write failure	The computer was not able to write to the electrically erasable EEPROM. **Replace EEPROM U-18. U-18 contains the personality portion of this elevator, replacing this chip will mean that all field modified parameters will need to be re-entered, or notify Elevator Controls so that they can be incorporated with new chip.**
Door open limit & door lock on simultaneously	Door lock input is active and, door open limit (DOL or DOLR) is open. One of the two inputs is incorrect if the doors are fully closed the DOL limit is bad, and if fully open the door lock is bad. **Correct either door open limit or door lock switches**.
Starter stuck in Wye or bad starter output	No DEL input or feedback is being received and the Delta output has been activated. **Bad delta contactor or auxiliary contact, or bad IO-7 or PIO9 output or input.**

Fault Conditions that Will Prevent the Car from Running (continued)	
Door reopen input active	The door open button or safety edge is still active and the doors are already fully open.
DCL: Doors not closed	Door lock is made but door closed limit still closed. **Re-position DCL switch as to open while the doors lock.**
Motor run stall protection timer expired	The car did not reach destination during the time allowed to be with the pump motor on. This problem occurs if car can not level into a floor due to malfunction of valves, or the Motor limit timer is too short for the distance required to travel. **Verify Motor stall protection Timer, refer to the Field Reprogramming Manual, and make sure car is capable leveling at every landing especially terminal landings without opening the normal terminal switches.**

7.2.2 ASME-17.1A fault Monitoring

The table below shows the different faults that can be generated from the ASME-17.1A monitoring portion of the system as follows:

a. Message: Indicates the display shown on the LCD display for each fault.

b. Output: The response of the system by dropping Stop relay only, or Stop and GTS-GTSX combination depending on the severity of the fault.

c. Reset Required Yes: Indicates that in order for the car to return to normal the fault generating problem has to be resolved and the ANSI-Reset push button has to be pressed to clear the fault. Reset Required No: will allow the car to return to normal operation as soon as the problem causing is resolved.

d. Conditions Producing Monitor Fault: Indicate the input and output flags that are involved to generate such faults.

e. Description and Possible Solution: Explains how the fault was generated and what may be a corrective action to resolve fault.

f. Address of Bit in Memory: Indicates where in memory the computer stores the state of the monitored points, please refer to the Field Reprogramming Manual to see how to access these memory locations.

Fig 7.4 ASME-17.1A Monitor Errors

Message	Output	Reset Required	Conditions Producing Fault	Description and Possible Solution	Bit Memory Address
Governor contact fault.	Reset gtsOut	Yes	GOV = 0	Governor auxiliary monitored contact opened. **Verify Governor mechanical operation, reset Governor**.	F1C2 bit 1
Contactor drop system fault **Note: Fault active also on Non- ANSI-2000 Controllers**	Won't run until fault clears	No	MGR = 1 STPM = 1	Contactor relay output is on and monitoring input is on. **Bad contact on AA, BK, H, or contactor auxiliary, see page 3 of job prints for reference**.	F007 bit 7 F1C2 bit 5
GTS relay fault	Reset inStop and gtsOut	Yes	GtsOut = 1 GTSM = 1	GTS relay output and GTSM monitoring contact is active. **GTS or GTSX or both relays are bad.**	F1CE bit 0 F1C2 bit 0
Stop relay fault	Reset inStop	No	HDBM = 1 INS-STOP= 1 STOPM = 1	Door lock bypass is off, INS-STOP output is on and STOPM monitoring contact is active. **Bad STOP relay.**	F1C2 bit 6 F1CE bit 5 F1C2 bit 3
Front door limit system fault	Won't run until fault clears.	No	DCLF = 0 DOLF = 0	Door open limit front and door closed limit front are both open. **Bad IO or PIO9 board or field problem**.	F006 bit 0 F000 bit 7
Rear door limit system fault	Won't run until fault clears.	No	DCLR = 0 DOLR = 0	Door open limit rear and door closed limit rear are both open. **Bad IO or PIO9 board or field problem.**	F006 bit 1 F005 bit 7
Door zone relay fault	Won't run until fault clears.	No	DZORDZ = 0 DZM = 0	Door zone input is not active and DZM relay monitoring contact is also not active. **Bad DZ relay.**	F01A bit 0 F37F bit 2
Door zone relay fault	Won't run until fault clears.	No	DZORDZ = 1 DZM = 1	Door zone input is active and DZM relay monitoring contact is also active. **Bad DZ relay.**	F01A bit 0 F1C2 bit 2
Door lock relays fault	Won't run until fault clears.	No	CGF = 1 DLM=1 Or CGR=1 DLM=1	Car gate CG Front or CG Rear, and Hoistway door locks are open but monitoring input DLM is not active. **Bad CG relay.**	F1C2 bit 7 F1C3 bit 0 F1C3 bit 5 F1C3 bit 0
Door lock relay fault	Won't run until fault clears.	No	CGF = 0 CGR = 0 HDR=0 DLM=0	Car gates inputs are active and CG monitoring contact is also active. **Bad CG relay or HDR relay, or both relays are bad.**	F1C2 bit 7 F1C3 bit 5 F1C3 bit 4 F1C3 bit 0

ASME-17.1A Monitor Errors (continued)

Level relay fault	Won't run until fault clears.	No	lvlOut = 1 LU = 1 LVLM = 1	Car is allowed to level into a floor LU input is active and LVLM monitoring input is active. **Bad LVL relay.**	F1CD bit 0 F01C bit 7 F001 bit 1
Level relay fault	Won't run until fault clears.	No	lvlOut = 1 LD = 1 LVLM = 1	Car is allowed to level into a floor LD input is active and LVLM monitoring input is active. **Bad LVL relay.**	F1CD bit 0 F01C bit 6 F001 bit 1
Bypass system fault	Won't run until fault clears.	No	INS = 1 HDBM =1	Inspection input not active inside memory, LED indicator on IO-7 or PIO9 On, and HDBM Switch monitoring input still active. **Bad IO-7,or PIO9 or bad HLS-7 bypass Switches.**	F001 bit 7 F1C2 bit 6
Door lock system fault	Won't run until fault clears.	No	IN = 0 CGF = 1 DOLF=0 DCLF=1 THD=0	Car not on inspection, front doors fully open, and car gate is closed. **Bad IO-7 or PIO9, or bad Door open limit front Switch.**	F001 bit 7 F1C2 bit 7 F000 bit 7 F006 bit 0 F1C3 bit 1
Door lock system fault	Won't run until fault clears.	No	IN = 0 CGF= 0 DOLF=0 DCLF=1 THD=1	Car not on inspection, front doors fully open, and hoistway doors still closed. **Bad IO-7 or PIO9, or bad hoistway door lock Switch.**	F001 bit 7 F1C2 bit 7 F000 bit 7 F006 bit 0 F1C3 bit 1
Door lock system fault	Won't run until fault clears.	No	IN = 0 CGR= 1 DOLR=0 DCLR=1 HDR=0	Car not on inspection, rear doors fully open, and car gate is closed. **Bad IO-7 or PIO9, or bad Door open limit rear Switch.**	F000 bit 7 F1C2 bit 7 F005 bit 7 F006 bit 1 F1C3 bit 1
Car stop bypass relay fault	Won't run until fault clears.	No	IN = 0 CGR= 0 DOLR=0 DCLR=1 HDR=1	Car not on inspection, front doors fully open, and hoistway doors still closed. **Bad IO-7 or PIO9, or bad Door open limit Switch.**	F000 bit 7 F1C2 bit 7 F005 bit 7 F006 bit 1 F1C3 bit 1
Car stop bypass relay fault	Won't run until fault clears.	No	CSB = 0 CSBM = 0	CSB relay output is off, and CSB monitoring contact input is also off. **Bad CSB relay.**	F007 bit 6 F1C2 bit 4
Car stop bypass relay fault	Won't run until fault clears.	No	CSB = 1 CSBM = 1	CSB relay output is on, and CSB monitoring contact input is also on. **Bad CSB relay.**	F007 bit 6 F1C2 bit 4

ASME-17.1A Monitor Errors (continued)

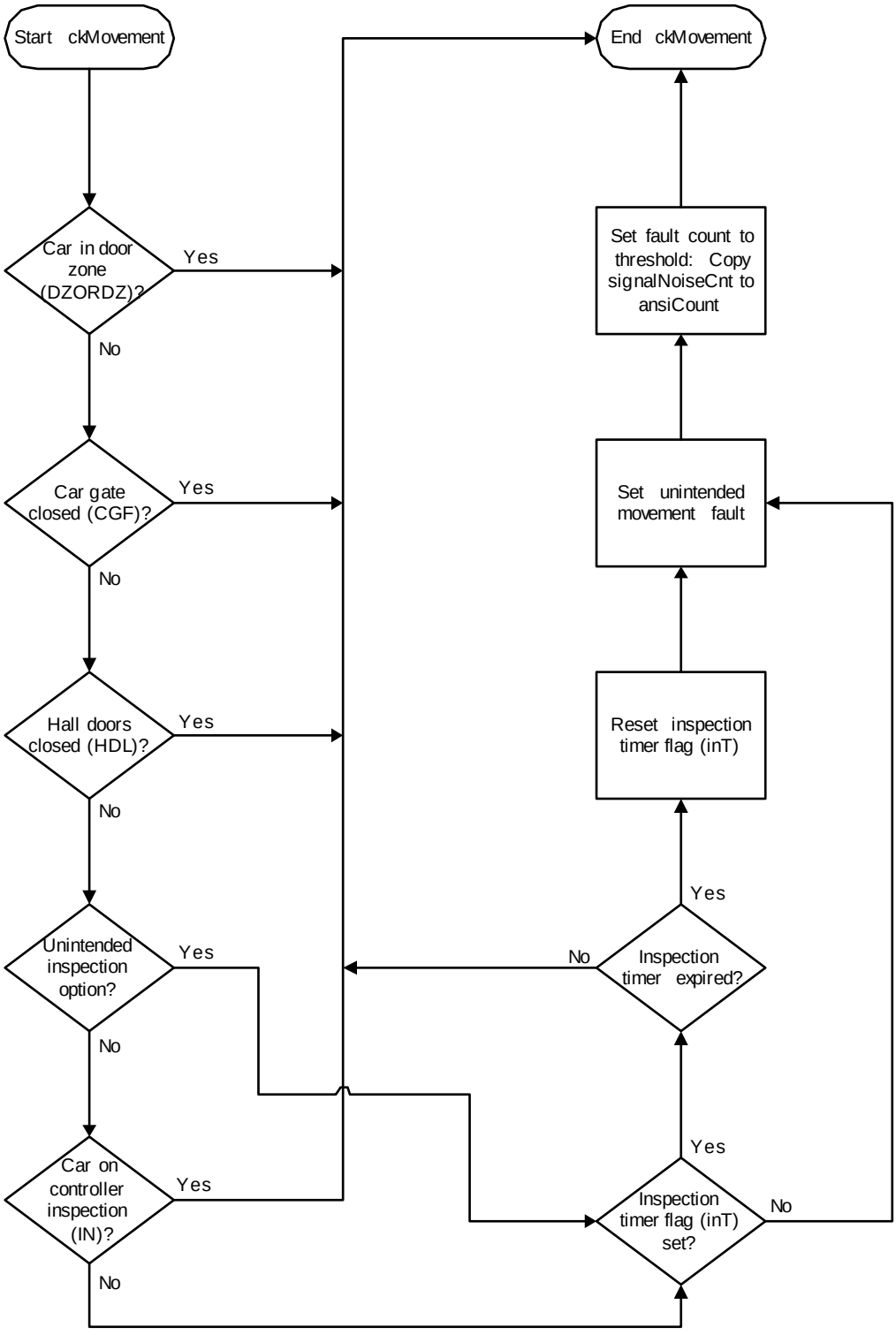
Inspection switch fault	Won't run until fault clears.	No	InsACC = 1 or InsCT = 1 or	Main inspection input is off, and one of the inspection mode inputs is on. **Bad IO-7 or PIO9, or bad Inspection, car top or in-car, or Access switches bad.**	F01C bit 2 F01C bit 4
Inspection switch fault	Won't run until fault clears.	No	insINC = 1 INS = 0 insACC = 1 insCT = 1	Main inspection input is on, and access input and car top input on. **Bad Access switch.**	F01C bit 3 F001 bit 7 F01C bit 2 F01C bit 4
Inspection switch fault	Won't run until fault clears.	No	INS= 0 insACC = 1 insINC = 1	Main inspection input is on, and access input and in car input on. **Bad Access switch.**	F001 bit 7 F01C bit 2 F01C bit 3
Inspection switch fault	Won't run until fault clears.	No	IN = 1 insCT = 1	Main inspection input is on, and in car and car top input on. **Bad in car inspection switch.**	F001 bit 7 F01C bit 4
Drive Relay fault	Won't run until fault clears.	No	Hydro = 0 SAF =1 SSM =1 DSAF=1	Drive Unit safety relay has Normally open and closed contacts active. **Bad DSAF relay, relay is located in the drive unit.**	FF03 bit 0 F005 bit 5 F01F bit 2 F1C3 bit 2
LSSM Relay fault	reset inStop and gtsOut	Yes	Hydro = 0 UPS/DNS = 1 SSM =1 LSSM=1 SU/ SD =1	LSSM tripped or bad LSSM relay. **Bad LSSM relay or tripped LSSM board relay is located on LSSM board.**	FC92 bit 0 FF01 bit 3/2 F005 bit 5 F01F bit 0 F07 bit 2/1
Unintended movement system fault **Car will stop immediately. Manual reset is required.**	reset inStop and gtsOut	Yes	INS = 1 DZORDZ = 0 THD = 0 CG=0	Car is not within door zone area, not on inspection mode, and the car gate and hoistway door lock string are open. **Correct door lock string, and car gate lock switches. Note: While releasing car from car top inspection there is a time-out period to allow the technician to close doors and release car before tripping occurs.**	F01C bit 3 F01A bit 0 F1C3 bit 1 F1C2 bit 7

7.2.3 ASME-17.1A Fault Monitoring Flow Charts

The following section contains a series of flow charts showing the different scenarios that create an ASME-17.1A monitoring fault. Flow chart analysis may aid understanding of system processes In order to resolve problems that may occur with the elevator control system.

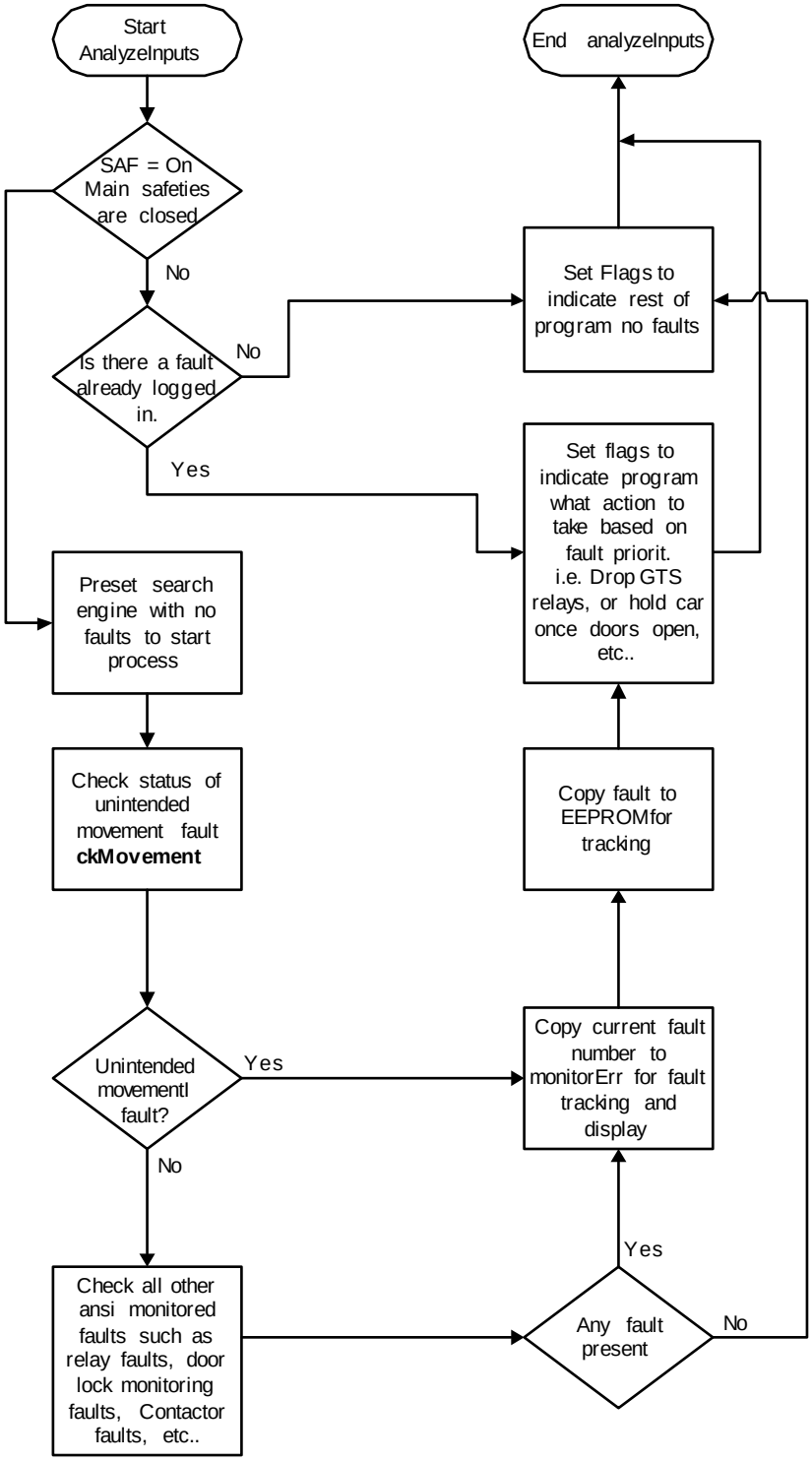
7.2.3.1 Unintended Movement Flow Chart

The following flow chart shows the status and events that result in Unintended Movement Fault.



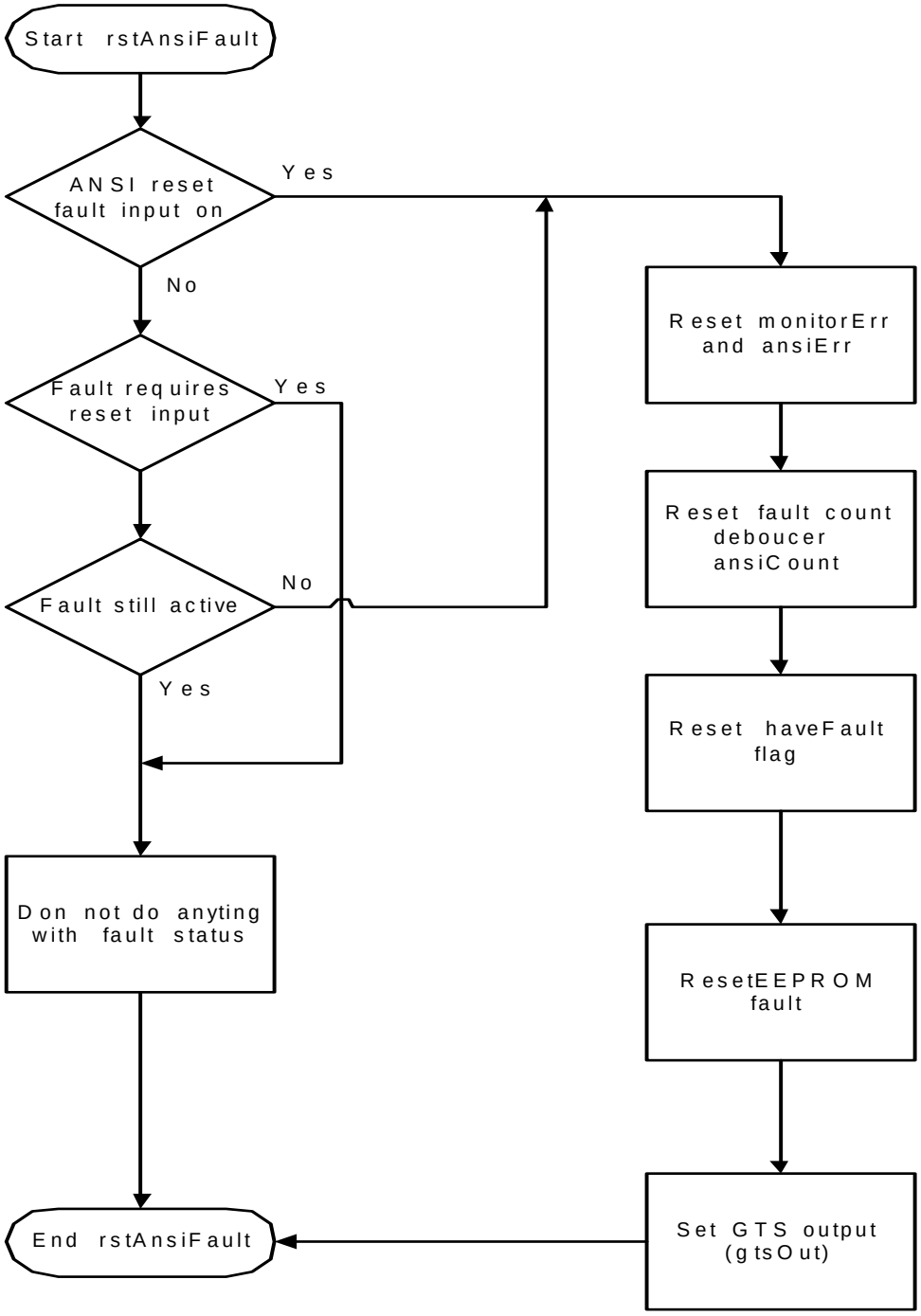
7.2.3.2 ASME-17.1A Monitoring Analysis Input Fault Flow Chart

The following flow chart shows the fault-scan process for logging and responding when an ASME-17.1A monitoring fault is detected.



7.2.3.3 ASME-17.1A Fault Reset Process Flow Chart

The following flow chart shows the fault reset process required by the monitoring programs for both latching faults (faults requiring the reset fault input) and not-latching faults (faults which the program will auto reset once the fault condition clears).



7.3 Malfunctions in the Operating System

7.3.1 Doors Operating Improperly or Not at All

Problem	Solution
Blows fused F8 and/or F7 and/or Resistor (RD1) Overheats (25ohms 225W).	Test For: (1) Damage to relays O, C, or CX. (2) Mechanical trouble on door operator on car.
Problem	Solution
No operation of doors, DO and DC relays operate OK, fuses F7 and F8 are OK.	Check: (1) All components in the O, C, and CX relay circuits, and (2) Mechanical trouble on door operator on car.
Problem	Solution
Doors operate one direction only and correct DO and DC relays are operating.	Test for contact closure across proper relay--DC for close, DO for open.
Problem	Solution
Doors operate one direction only. Only one DO or DC relay will operate.	Check DOF/DCF indicator on I/O7 or PIO9 driver board. (Refer to Microprocessor Troubleshooting Guide). Turn "NORMAL-TEST" switch on HLS-7 board to NORMAL."
Problem	Solution
Door speed incorrect at either end of travel. Doors slam or drag.	Check: (1) Slowdown cams that operate slowdown resistors on door operator on car top. Readjust if necessary; and (2) Spring operated door closer on hoistway door.
Problem	Solution
Doors open a few inches or less at one particular landing and appear to be mechanically stuck but re-close so car can leave.	Readjust upper and lower link connections on lift rod for door lock so that lock properly clears lip of enclosure.
Problem	Solution
Other mechanical problems with doors.	Refer to drawings relating to mechanical portions of door operator.

7.3.2 Call Button Problems

Problem	Solution
Car responds to call button but call registration lamp will not light.	After verifying that the bulb is not burned out, check to see if the problem is internal to the controller or in the external wiring. This is most easily observed by noting if associated LED is lit. If it won't show call registration, check for voltage on call common supply. Should the common voltage be correct, replace the associated input/output driver board.
Problem	Solution
Car will not respond to a specific call.	If the system does not register a call (or a group of calls) but the car functions normally otherwise, the call information is not reaching the computer data storage memory. First make sure that the car and hall call common (terminal 6 for car calls or terminal 50 for hall calls) have proper fixture voltage with respect to 3 buss. Next, check the terminals on the controller. One easy method of determining whether the problem is internal to the controller or in the external field wiring is to momentarily jumper 3 to the call terminal number in question. If the car responds to the call, the problem is external. If not: (1) Check that when call terminal is jumpered to terminal 3, the corresponding LED lights up, then refer to microprocessor troubleshooting section to check the computer CCD (HCDX) - Car (Hall) Call Disconnect - function inside computer indicating computer not accepting calls. (2) Replace the associated input/output board.

7.3.3 Position Indicator Malfunctions

Problem	Solution
Position indicator is out of step with the elevator car physical position	The computer system contains automatic synchronizing logic to place the position indicator in step with the car whenever it reaches a terminal landing. Therefore placing a call for a terminal landing should resynchronize the position indicator. Should the car get out of step repeatedly, or the position indicator jumps from terminal to terminal, a stepping problem in indicated. Verify proper operation of the DZ, STU, STD (and ISTU and ISTD, if provided) inputs, making sure that the proper signal LED operates when magnetic switch is on a vane (note that STU/STD, ISTU/ISTD indicators go off when input is active), and signal reaches the appropriate controller input terminal. Also check for missing or damaged hoistway vanes, and make sure that activation of STU or STD does not overlap with activation of DZ or LU/LD.

NOTE: The position indicator is strictly under software control and will not respond if the car is moved manually by using the car top inspection station.

7.4 Proper Stepping Sequence

This section is intended to describe the state of the stepping signals required to execute an automatic run, and to illustrate how the elevator computer, P8 or PIO9, keeps track of the car movements as it travels from floor to floor.

7.4.1 Initial Selector Status

While the Car is at a landing floor level

1. The DZ indicator LED will be lit, indicating car is at floor level.
2. STU/STD signals at IO-7 or PIO9 board LED indicators, or at memory location F000 are lit. Refer to the Field Reprogramming Manual “Memory Flags List” menu.
3. Indicating that stepping inputs are not active, i.e. they are active low.

7.4.2 Re-Arming the Selector

1. As car travels out of the door zone area, the DZ indicator should turn off.
2. The STU (or STD for down) indicator will turn off as the stepping signals from the selector unit are sent to the P8 or PIO9 microprocessor, the Position indicator output will reflect the new floor position.
3. Further activation of STU/STD will be ignored until after DZ is cycled (on/off), "re-arming" the electronic selector for stepping at the next floor.

7.4.3 Car Approaching a Stop at Floor

1. Once the target floor is reached and the target STU/STD signals arrive to the P8 or PIO9 board causing the elevator microprocessor to update position to match the target position.
2. After the last STU/STD signal, the P8 or PIO9 drops the H relay output.
3. As the car travels into the Door Zone area, it is driven into final stopping position by the LU and/or LD leveling sensors.

7.5 Microprocessor Troubleshooting

This section is intended to help determine if the Computer Logic Check indicates a faulty board, and if so, which if any of the microprocessor system logic boards is bad so that a good board can be substituted. No attempt has been made to diagnose specific problems that might occur on any particular board, since doing so requires specialized test equipment, which is not generally available to elevator service mechanics in the field.

Assume it has been determined that an output signal is not being sent by the computer system when conditions indicate that a signal should be present. The next step is to determine whether the computer is attempting to turn on the output or not, and if not, what might be preventing it from doing so.

To find out what the computer is trying to do or "thinking", look into the computer memory itself using the onboard diagnostics described in the Field Reprogramming Manual.

7.5.1 Troubleshooting Example

For example, let's say you note that the door open output fails to operate door open relay DO in response to a door opening input signal. You observe that the DOF (door open function) output LED indicator does not turn on. Set the diagnostics switches as described in the Field Reprogramming Manual. Locate the DOF function on the Memory Flags Listing page, which indicates an address of F007 for DOF. Check the LED indicator corresponding to address location F007 and observe that the LED is off.

This tells us the computer is not turning on the Door Open output. This must mean that either the open signal input (say door open button DOBF address F001 is not coming in, or the computer incorrectly thinks doors are already fully open (DOLF - door open limit front input is zero, address F000). Alternatively, the computer may have determined it unsafe to open doors (DZ=0 or HIR=1). Inspection of these flags will show that either (1) an input was not supplied to the system properly, or (2) that the computer cannot see it. In the later case, it is suspected that the I/O7 or PIO9 board (especially if DOBF and DOLF do not track input signals) or ribbon cable connecting the I/O board to the computer board is faulty for standard controllers.
Based on the methods used in this example, any other input/output can be traced to the computer memory to help identify the cause of the fault. The section following illustrates the computer logic used to process the indicated outputs and signals.

7.6 Operational Logic Description

The following description of computer logic control is described in a synthesized format (Boolean logic flow equations). They are very simple to read and understand if the following guidelines are understood:

a. The logic equations below use signal abbreviations, as listed in the Field Reprogramming Manual, which are referenced in the job prints describing input/output signals. Straightforward signal abbreviations aid understanding (e.g., DOB=door open button, DC=Down Call cancel, etc.).

b. The small zero superscript used on a signal name indicates that the signal is active when off, or it is otherwise required that the signal go off in order for something else to happen. Thus, $DOLF^0$ is a signal that, when on, indicates that doors are not fully open. When off, $DOLF^0$ indicates that doors are fully open.

c. The plus symbol + is used to indicates an OR function. Thus, the equation: DOB+SE reads, "either door open button input OR safety edge input". Likewise, the & symbol is used to indicate an AND function. Thus the equation DOI & $DOLF^0$=DOF reads, "door open intent on AND door open limit off will generate a door open function output". Please note that the words AND and OR are used instead of & and + symbols when combining two smaller equations.

7.6.1 Door Open Function Output - DOF

(Demand) CCF+UC+DC OR (Input) DOB+SE+PHE+DHLD AND DZ = DOI
DOI & $DOLF^0$ = DOF

7.6.2 Door Open Function Rear Output - DOFR

SAME AS ABOVE, FLAGS ARE SUFFIXED WITH LETTER R: CCFR, UCR, ETC.

7.6.3 Computer Up Output - SU

Start: DZ & DLK^0 & HIR & DMU & DCL^0 = SU
Hold: $HIR+DZ^0$ AND SU & DLK^0 = SU

7.6.4 Computer Down Output - SD

Same as SU above, replace DMU/SU with DMD/SD.

✍ **NOTE**: DMU/DMD are the demand flags, they are set any time the computer is requested to move the car in response to a call (SUA+SDA = 1), car lost (BFD+TFD =1), parking demand (UPF+LPF = 1), fire or emergency recall (FRM+EPR).

7.6.5 High Speed Output - HR

Start: DLK^0 & EQA^0 & (DMU & USD1 + DMD & DSD1) & LVL & DOI^0 = HR
Drop: CCT+HCT+CCF+CCR = HR^0 . Call answered.
OR DMU^0 & DMD^0 & (SU & STU + SD & STD) = HR^0. Lost demand.
OR DLK+EQA+(DNS & $DSD1^0$)+(UPS & $USD1^0$) = HR^0. Not save for HR.

7.6.6 Call Disconnect and Reject - CCD, HCDX, HCR

A. CCD - CAR CALL DISCONNECT (CAR CALLS WON'T LATCH):
IN+EPI+FRM+EPS+EQA+MLT+INC+ISR^0+TFD+BFD+CCDFU+CCDFD = CCD

B. HCDX - HALL CALL DISCONNECT (HALL CALLS WON'T LATCH):
FRS^0+FRA^0+EQA^0 = HCDX. If duplex both car's flags are considered.

C. HCR - HALL CALL REJECT (CALLS LATCH BUT CAR WON'T RESPOND):

INC+FRM+EQA+TOS+ISR^0+HLW+SAF^0+IN+EPS = HCR

✍ **NOTE**: Even if HCR=0 (CCD=0), Hall (car) calls will be ignored by computer (even when latched-in if car stopping table indicates car should not respond to such call. See Car Stopping table in field re-programming manual.

7.7 Section Intentionally Left Blank

7.8 Hardware Logic

7.8.1 Computer Power Supply

The proper voltage to the computer board is +5VDC +/-5%; this voltage should be checked at the power supply +OUT to -OUT terminals. Adjust with caution, as a trip out will result if voltage is adjusted too high. To reset a trip, reduce the voltage adjustment, then cycle power.

CAUTION: Adjusting output too high will cause the unit to trip.

7.8.2 Microprocessor Board

On the microprocessor board there are nine LED's (light emitting diodes), five pushbuttons, and four switches. The On LED for the P8 or the Status LED for PIO9 microprocessor being on indicates that the board is running but not necessarily functioning normally. The eight remaining LED's (in a row) display error/status codes (the LCD display will display this information in English format when provided). In general, the car A/B switch toggles the function of the eight LED's as indicators for CAR A (if the switch is UP) or CAR B (if switch is DOWN). Note that CAR A/B switch is not used for V900 control systems. Refer to the Field Reprogramming Manual for more details on the use of microprocessor PC board switches.

WARNING: Do **NOT** depress the microprocessor-reset button while any car is running, as it will cause an emergency stop. Use extreme care.

A group of special conditions are recognized by the microprocessor. If one of these "errors" occurs, a code will be displayed corresponding to that condition. The microprocessor will scroll up to six errors at a time, which show on the LCD display. The eight LED array will display the error that needs too be corrected first, that is, the one with the highest priority. The field technician should look first to the LED array to identify the error that needs to be corrected first. Error codes can be found in Section 5 of this manual and on the inside of the control equipment enclosure door.

Not all system errors are detected and displayed by the P8 or PIO9; however, the most frequent errors have been programmed to be recognized. Even the fact that the door lock string is open, as it sometimes is during normal operation, is defined with an "error" code, which is frequently displayed during normal operation.

7.8.3 I/O-7 or PIO9 IO Section, Board (I/O-EX board)

The I/O board performs the task of buffering or protects the five volt computer logic environment from the electrically noisy 110 volt outside world. For this reason, most microprocessor system problems occur on the I/O boards.

The input buffer section of the I/O accepts high-level inputs from the HLS-7 board or car signals, and converts them to five volts computer signals. The I/O board also provides low-pass filtering to reduce noise susceptibility and Schmitt triggers to increase noise margin. The relay and signal driver sections of the I/O board provide high voltage switching outputs that actuate relays on the HLS-7 module and general elevator signals.

The output portion of the IO-7 or PIO9 or IO-EX is field replaceable. The replaceable components consist of an output Triac and a Zener diode, which can be identified by the corresponding LED number (i.e. LED 77 corresponds to Triac 77 and Zener diode Z77).

To determine if the Triac is bad, note that normal behavior of the output will be to turn on such signal as soon as power is applied to the controller. If the Zener diode is shorted, the output will not come on until the controller turns it on, and once turned on it will not be able to be turned off.

A Zener diode has the same characteristics as a standard diode. Using a standard multi-meter on diode check mode, the diode shall conduct in one direction only, when the positive meter lead is placed on the anode side (non-belted side of the diode) and the negative lead on the cathode side of the diode, and shall not conduct if meter leads are reversed. If a diode conducts in both directions, it is shorted and needs to be replaced.

If a Zener diode requires replacement, remove it using a pair of pliers. Trim leads on the replacement diode to the proper length, and then carefully insert the new diode into position.

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Section 8 – Group System

8.1 Detailed Explanation of Group Dispatching Subsystem

Since an elevator is a continuous, real-time machine, the supervisory control subsystem microcomputer (or microprocessor) is designed to operate in a loop, performing a predetermined pattern of instructions many times each second. Its speed is such that each elevator control function appears to be continuously monitored. The basic control loop and the functions performed by the computer during each portion of that loop are described below.

8.2 Data Acquisition

Before any logic decisions can be made data must be acquired during the first portion of the control loop called "contact scan." The microprocessor interrogates each input (hall calls, car calls, and power subsystem inputs) and saves the data in storage memory. This data is used during the rest of the control loop. In effect, the controller takes a "snapshot" of the entire elevator system, and then it makes decisions based on that information. Snapshots are made many times each second providing functionally continuous system monitoring.

8.3 Fireman's Service

After data has been acquired, proper outputs are computed for fireman's service.

8.4 Stepping

The next major block in the control loop deals with stepping. The system has no mechanical floor selector so, when power is first applied, the Supervisory Control system checks to see if the car is at the top landing (on the up slowdown limit) or at the bottom landing (on the down slowdown limit). If the car is at either of these locations the internal electronic "selector" is set to the proper value.

If the car happens to be somewhere mid-hoistway when power is first applied, the system will create a phantom call, and run the car until it reaches a terminal landing, whereupon it will become synchronized. After initial synchronization, magnetic vanes placed in the hoistway inform the Supervisory Control System when the car passes each floor. The internal electronic "selector" updates accordingly.

The stepping point is actually one slowdown distance ahead of each floor. When the car steps into any given floor, the control system determines if there are any calls registered for that floor, and if so, initiates a slowdown and cancels the calls. This method requires no mechanical attachments to the car, such as chains, wires, or tapes.

After the controller processes data pertaining to a moving car it scans all calls present and selects a direction preference for the car (if it is not already answering a call).

8.5 Door Operation

The next block in the control loop is concerned with door operation. While the car is running, this portion is bypassed, but when the car enters a door zone this block becomes active. Functions performed by the door-processing block include door holding times (hall call time, car call time, and shortened door time), door opening and closing, and permission to proceed at high speed. The car actually moves in response to signals generated during door control loop processing, since all interlocks and timers (as well as car panel button inputs) must be correct before car movement is allowed.

8.6 Indicator Lamps

The final block of the control loop uses data generated by all previous calculations and calls stored in memory to light the appropriate car panel and hall indicator lamps. Once this has been accomplished, the loop is completed and the processor starts the next contact scan.

The entire loop process is repeated many times each second for a smooth and, to all outward appearances, continuous operation.

It should be noted that the power-up logic, in addition to correctly presetting the floor selector memory location, clears all memory locations and output buffers prior to applying any signals to the power control subsystem, ensuring safe, stable operation.

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Section 9 – Maintenance

9.1 Maintenance

The Elevator Controls Microprocessor Elevator Controller has been designed to require as little routine maintenance as possible. In fact, the mechanical interconnections are the least reliable portion of the solid-state system, and the less they are disturbed, the more likely the system is to continue to function properly.

The elevator itself, however, is a complex mechanical apparatus, and therefore requires periodic routine preventive maintenance. In addition to lubrication of the various moving parts, the door lock contacts should be cleaned and inspected regularly since the exposed contacts are susceptible to dirt and corrosion. The doors also receive the most wear, often making two or even three cycles at a floor.

The various rotating machinery belts and couplings should be routinely inspected for wear. Wear could cause loss of control of the elevator car.

If the elevator system develops problems or becomes inoperative refer to the Troubleshooting guide Section 7 of this manual.

9.2 Replacement Parts List

9.2.1 Elevator Controls PC Boards

1) P8 Main microprocessor board (Standard controllers only)
2) IO7-Vxx Main input-output board (Standard controllers only)
3) IOEX-B44 ASME-17.1A-2000 monitoring board (Standard controllers only)
4) IOEX-Vxx Input-output expander board.
5) LSSM-5 Speed monitor board.
6) PIO9 Main microprocessor board (Prodigy controllers only)

For EZ-Link systems only

1) P8X Controller to serial link microprocessor board (Standard controllers only)
2) TOC Car top microprocessor board.
3) COP Car panel microprocessor board.
4) Hall Microprocessor for hall stations.
5) COP/TOC-EX Car top or COP extender board.

✍ **NOTE**: xx is the fixture voltage

9.2.2. Relays

4 pole ice-cube 120 VAC
P&B KHAU-17A12N-120
Omron MY4AC110/120S
Idec RU4S-D12

4 pole ice-cube 110 VDC
P&B KHAU-17D12N-110
Omron MY4-DC12S
Idec RU4S-A12

3 pole ice-cube 110 VDC
P&B KUP-14D35-110
Omron RR3B-ULDC110V

Power 2 poles 30-amp 110VDC relay with DC Blow-outs
P&B PRD11DH0-110VDC

Force guided relay
Shrack SHRACK V23050-A1110-A533, 110 VDC

9.2.3 Fuses

AGC ¼, 1, 2, 3, 5, 6,10, 15 AMP 250VOLT
MDA TYPE 3, 5, 10 & 15 AMP 250 VOLT
FRN-R 10, 20, 30, 60 AMP 250 VOLT (208 to 240 VAC power supply)
FNQ 5,10,15A 500 VOLT (440 to 480 VAC power supply)

9.2.4 Power Supply

Power One HB5-3/0VP 3-AMPS @ 5VDC

9.2.5 Semiconductors

Motorola HEP-RO170
Motorola 1N5347B – 10V, 5 Watt, Zener Diode
Motorola 1N5333B – 3.3V, 5 Watt, Zener Diode
Tecor L4004F31 – 4 AMP, 400 VOLT, Sensitive Gate Triac

Appendix A1
Yaskawa F7 AC Vector Drive Unit

A1 Motor Drive Parameters

A1.1 Drive Operational Overview

Review and become familiar with the YASKAWA F7 Drive User Manual. For simplified reference we will refer to it as the Drive Manual.

Pay particular attention to all safety precautions. Study the job prints, noting that the interface to the drive consists of basic drive inputs including:

a. Direction / run inputs

b. Speed selection signal inputs

c. Power inputs to terminals R/L1, S/L2 and T/L3

d. Encoder inputs, for Closed Loop Vector control systems only

The basic outputs are:

e. 3-Phase output to motor through contactor

f. Fault output (drops DSAF relay if a fault condition is detected)

g. Drive run output

h. ABS speed output

CAUTION: Do not connect the building power supply directly to the motor contactor.

WARNING: Power capacitors in the drive remain charged for some time after power is removed. Use care to prevent injury.

Familiarize yourself with the use of the drive's Digital Operator in the Drive Manual Chapter 3, including use of the keypad as described below.

Parameters may be accessed using the Quick Setting Menu (-QUICK-) which is used to set/read the most commonly used parameters or the Programming Menu (-ADV-) that is used to set/read every available drive parameter. The letters Q and A have been used, respectively, to indicate which mode is required to access each parameter.

NOTE: The Auto Tuning Menu (-A.TUNE-) can be used to auto-tune the motor drive. This function will calculate the required motor parameter settings for optimized motor performance. Auto-tuning is ideally performed with the motor disconnected from the load. When this cannot be accomplished, static or terminal resistance tuning can be done. To be able to perform Auto-Tuning disable Base Block option H1-02 from 8 to F, and set back to 8 once Auto-Tuning has been completed.

✍ **NOTE**: Do not change any parameters except those found in the following tables. Other parameters are either not used in this particular application or are pre-programmed to EC default settings.

Verify that the parameters are as listed on the job-programming list supplied with the Elevator Controls job prints. Parameters listed below have been changed from the drive manufacturer defaults by Elevator Controls. Parameters noted (*) may need to be fine tuned during adjustment.

A1.2 F7 Drive Parameter Programming

The F7 drive is used in both Closed Loop Vector Control with Encoder Feedback and Open Loop Vector Control without encoder feedback.

The difference between the two is the drive operation mode and the stopping method of control "Ramp to Stop" for closed loop Vs "DC-Injection" for open loop, and the additional encoder feedback on Closed Loop Vector Control. Different parameter settings are also used as follows:

Parameter #	EC Setting	Access Level	Comments
Drive Configuration and Stopping Method for Closed Loop Vector Control Only			
A1-02	3	Q	Flux Vector Mode. Requires encoder.
B1-03	0	Q	Ramp to Stop.
Encoder Feedback Parameter Configuration for Closed Loop Vector Control Only			
F1-01	1024 (*)	Q	Encoder Pulses per Rev
F1-02	0	A	Ramp to stop with PG Fdbk loss
F1-03	0	A	Ramp to stop with PG overspeed
F1-04	0	A	Ramp to stop with PG speed deviation
F1-05	0 (*)	A	PG rotation; 0: up = CCW, 1: up = CW
Drive Configuration and Stopping Method for Open Loop Vector Control Only			
A1-02	2	Q	Open loop Vector Mode.
B1-03	2	Q	DC Braking to Stop.
B2-01	2 (*)	A	DC Injection time at start = 0 sec (used if rollback)
B2-02	75 (*)	A	DC Injection current. Increase as needed for stop.
B2-04	2 (*)	A	DC Injection time at stop.

✍ **NOTE**: For Closed Loop Vector Control systems only – The encoder feedback unit (attached to the hoist motor) Pulses per Revolution data must match the programmed value in F1-01 parameter.

✍ **NOTE**: Open Loop Vector Control method may not yield best results with motors whose very high slip and other properties are substantially different from standard NEMA B designs. For these applications, the control mode A1-02 will have to be set to A1-02 = 0, for variable frequency mode of operation. The other parameters apply to both variable frequency and open loop vector modes.

✍ **NOTE**: Switching from one mode of control method to another resets parameter C6-03 to 2 make sure to set it at 8 every time a control method switch is performed.

A1.2.1 System Constants

These drive parameters configure the drive for Elevator Controls' V900 Non-PVF operation.

Parameter #	EC Setting		Access Level	Comments
B1-05	3		A	Zero Speed Operation
C1-10	0		A	Acc/Dec time units resolution 0.01 sec.
C6-01	0		A	Heavy duty drive operation
C6-02	F		Q	Carrier Frequency – Determined by C6-03 thru C6-05
C6-03	8		A	Maximum Carrier frequency
C6-04	8		A	Minimum Carrier Frequency
L3-01	1		A	Acceleration Stall disable
L3-04	0		Q	Deceleration Stall disable
L5-01	2 (*)		A	Auto resets. Set to 2 or desired # of auto-resets
L5-02	1		A	Fault Relay Active during auto-reset
L6-01	2		A	Alarm @ Run on over-torque detection
L6-02	200 % (*)		A	Torque detection level
L8-07	1		A	Output phase loss enabled
L8-15	0		A	OL2 at low speeds disabled

A1.2.2 Drive Gain Adjustment Parameters

The "Drive Gain" parameter adjusts the sensitivity with which the drive follows the request speed pattern signal without undesirable vibration or discomfort. "Drive Gain" is adjusted, when required, by changing the following parameters:

- C5-01 and C5-02 in the drive submenu (ASR Tuning for Closed Loop Vector Control)
- C4-01 and C4-02 in the drive submenu Torque Compensation for Open Loop Vector control

The drive is shipped with drive gain preset to drive manufacturer defaults. Increasing the value of each parameter increases the drive's responsiveness to speed pattern signal commands.

Parameter #	EC Setting	Access Level	Comments
Drive Gain for Closed Loop Vector Control			
C5-01	20.00(*)	A	Automatic speed regulation gain
C5-02	0.500 sec (*)	A	Automatic speed regulation "dampening" time
Drive Gain for Open Loop Vector Control			
C4-01	1 (*)	A	Torque gain. Set to 1. Adjust up to 2 as needed for torque at slow speeds without excess current. Alternatively, set E1-08, E1-10 min and Mid output voltages for High Starting Torque (1 or 2 per manual). Use moderation to prevent excess current saturation.
C4-02	20 (*)	A	Torque gain time constant

A1.2.3 Motor Speed Calibration

The "Motor Speed" parameter is adjusted, when required, by changing the speed parameters D2-02 through D2-07, accessed using the Preset Reference menu, to set various speeds required for the job. The higher the frequency value, as reflected by a higher parameter setting, the faster the speed of the car when speed is selected.

Parameter #	EC Setting	Access Level	Comments
D1-01	0 Hz	Q	Zero Speed command
D1-02	3.5(*) Hz	Q	(L) Freq equal to leveling speed
D1-03	4.0(*) Hz	Q	(L2) Freq equal to re-leveling speed
D1-05	12(*) Hz	A	(HL) Freq equal to high leveling / Inspection speed
D1-07	55(*) Hz	A	(H) Freq equal to Rated speed
D1-08	30(*) Hz	Q	Freq equal to Earthquake speed

The relationship between car speed and speed parameter settings is based on Frequency (Hz) Vs Motor Rotation (RPM). To match the actual car speed to the desired car speed, determine the speed per Hz by measuring the actual car speed with a hand held tachometer, this value by the commanded speed Hz as follows:

a) Place the car on Controller Inspection.

b) Run the car on Inspection mode, up or down. Measure and record the actual car speed.

c) Divide the measured speed by the number of Hz programmed in setting D1-05, Inspection Speed. The result is speed per Hz.

d) Use the speed per Hz result to determine the value desired for each speed setting by dividing the desired speed value by the speed per Hz then programming the result into selected speed, for example:

   i) The car is running at 30 Ft/Min measured speed.

   ii) The inspection speed programmed for D1-05 is 10 HZ

   iii) The speed per Hz will be 30/10= 3 Ft/Min per Hz.

      (1) To calculate leveling speed at 6 Ft/min, divide the desired speed by the speed per Hz

      (2) Calculated above:

         (a) Desired Leveling speed (6 Ft/ Min) / (3 Ft/ min per Hz) = 2 Hz

         (b) Set D1-02 = 2 Hz

   iv) Repeat step d above to calculate values for the rest of the speed settings.

✍ **NOTE**: Speed settings, acceleration/deceleration rates, s-curve, and gain parameter initial and calculated values may need to be fine-tuned during final adjustment procedures.

A1.2.4 Analog Inputs

The drive analog inputs are not used for this control system application. Terminal A3 is disabled from the factory to prevent interference.

Parameter #	EC Setting	Terminal #	Access Level	Comments
H3-05	1F	A3	A	Terminal A3 not used

A1.2.5 Analog Outputs

These drive parameters configure the drive analog outputs to generate an actual car speed curve profile for speed monitoring, which can be observed with an oscilloscope for final ride tuning between terminals FM and AC.

Parameter #	EC Setting	Terminal #	Access Level	Comments
H4-01	5	FM	A	Motor speed output
H4-07	1		A	Set terminal FM output to +10 to –10 VDC

A1.2.6 Digital Outputs

These drive parameters configure the drive digital outputs to send drive operation mode signals to the Elevator Controls V900 Non-PVF controller.

Parameter #	EC Setting	Terminal #	Access Level	Comments
H2-01	0	M1 – M2	A	Drive on - closed during run
H2-02	5 (*)	M3 – M4	A	Output to turn on LSSM speed monitor
L4-01	10 Hz (*)		A	Freq to LSSM – Low speed safety monitor

A1.2.7 Digital Inputs

These drive parameters configure the drive digital inputs to receive digital commands from the Elevator Controls V900 Non-PVF controller.

Parameter #	EC Setting	Terminal #	Access Level	Comments
H1-01	24	S3	A	External Fault, N/O
H1-02	8	S4	A	External Base-Block N/O
H1-03	3	S5	A	Multi-Step Frequency Reference 1
H1-04	4	S6	A	Multi-Step Frequency Reference 2
H1-05	5	S7	A	Multi-Step Frequency Reference 3
H1-06	7	S8	A	Second Deceleration ramp selection

A1.2.8 V/F Pattern

These drive parameters configure the drive for main line power input and motor power output voltage and frequency.

Parameter #	EC Setting		Access Level	Comments
E1-01	Line Voltage (*)		Q	Set to proper line Voltage
E1-04	60 (*)		Q	Maximum Frequency = 50 for some Countries
E1-05	Motor Voltage (*)		Q	Set to Motor Nameplate voltage
E1-06	60 (*)		Q	Base Frequency = 50 for some Countries
E1-09	0.0		A/A/Q	Minimum frequency - Hz

A1.2.9 Motor Setup

These drive parameters configure the drive for the hoist motor.

Parameter #	EC Setting		Access Level	Comments
E2-01	Motor Amps (*)		Q	Motor full load amps on nameplate
E2-02	Motor Slip (*)		A	If unknown set = 60-(F.L. RPM x # of poles/120)
E2-03	No Load Amps (*)		A	If unknown set = 35% of E2-01 value
E2-04	# of Motor Poles (*)		Q	60 Hz - 900 RPM = 8, 1200 RPM = 6, 1800 RPM = 4

A1.2.10 Acceleration Deceleration and "S" Curve Parameters

These drive parameters configure the speed profile the drive will generate to start, accelerate, decelerate and stop the car. Refer to Section 3.x for configuration and speed profile details.

Parameter #	EC Setting		Access Level	Comments
C1-01	3.5 sec (*)		Q	Acceleration time 1
C1-02	2.0 sec (*)		Q	Deceleration time 1
C1-03	0.0 sec		A	Acceleration time 2
C1-04	0.1 sec (*)		A	Deceleration time 2
C2-01	0.50 sec (*)		A	S-curve at acceleration start
C2-02	0.50 sec (*)		A	S-curve at acceleration end
C2-03	0.50 sec (*)		A	S-curve at deceleration start
C2-04	0.50 sec (*)		A	S-curve at deceleration end

A1.3 Overspeed Using the Drive to Drive the Hoist Motor

The drive unit can be configured to run the hoist motor at a higher frequency than the hoist motor base input frequency to create an overspeed condition, accomplished task by manipulating parameters E1-04 Maximum Output Frequency, and D1-07 High Speed.

To overspeed the car to 125% of contract speed perform following steps:

a. Place the car on Test Mode of operation.
b. Run the car to the bottom landing.
c. Set E1-04 to 90 Hz.
d. Multiply the value in D1-07 by 1.25 and program the result into D1-07.
e. Call car via a car call to an intermediate landing (not the top landing).
f. The car will overspeed to 125% of contact speed.
g. For down direction, run the car to the top landing, then call it to an intermediate landing (but not the bottom landing).

WARNING: When performing an overspeed test, make sure all parameters are **RESET TO THEIR ORIGINAL VALUES** when testing is completed.

Appendix A2
Magnetek HPV-900 AC Vector Drive Unit

A2 Motor Drive Parameters

A2.1 Drive Operational Overview

Review and become familiar with the MAGNETEK HPV-900 Drive User Manual. For simplified reference we will refer to it as the Drive Manual.

Pay particular attention to all safety precautions. Study the job prints, noting that the interface to the drive consists of basic drive inputs including:

a. Direction / run inputs
b. Speed selection signal inputs
c. Power inputs to terminals R/R1, S/S1 and T/T1
d. Encoder inputs

The basic outputs are:

i. 3-Phase output to motor through contactor
j. Fault output (drops DSAF relay if a fault condition is detected)
k. Drive run output
l. ABS speed output

CAUTION: Do not connect the building power supply directly to the motor contactor.

WARNING: Power capacitors in the drive remain charged for some time after power is removed. Use care to prevent injury.

NOTE: The MAGNETEK HPV-900 Drive can only be used in closed loop vector control mode of operation.

Familiarize yourself with the use of the drive's Digital Operator in the Drive Manual, Parameters Section 3 starting on page 28, including use of the keypad as described below.

There are two types of parameters, standard and hidden. Parameter access levels are set in the drive's Utility UO menu, parameter U2 – Hidden Items. Note that the hidden parameters are only accessible when U2 – Hidden Items is “enabled”. Refer to Section 3.6 Utility U0 Menu in the Drive Manual for use of the utility functions.

NOTE: The Adaptive Tune procedure can be used to auto-tune the motor drive. This function will calculate the required motor parameter settings for optimized

motor performance. This procedure is explained in Section 5.7 of the HPV-900 Drive Manual.

✍ **NOTE**: Do not change any parameters except those found in the following tables. Other parameters are either not used in this particular application or are pre-programmed to EC default settings.

Verify that the parameters are as listed on the programming list supplied with the Elevator Controls job prints. Parameters listed below have been changed from the drive manufacturer defaults by Elevator Controls. Parameters noted (*) may need to be fine tuned during adjustment.

A2.2 HPV-900 Drive Parameter Programming

The HPV-900 is a Closed Loop Vector Control drive with Encoder Feedback, providing the following parameters configurations:

A2.2.1 System Constants

These drive parameters configure the drive for Elevator Control's V900 Non-PVF operation

Parameter #	EC Setting		Hidden Item	Comments
A1-1	(*)		N	Contract Car Speed in Ft/Min
A1-2	(*)		N	Contract Motor Speed In RPM
A1-14	125 (*)		Y	Overspeed Multiplier
A1-17	(*)		N	Encoder Pulses per Revolution
A1-35	3 seconds		Y	Fault Reset Delay
A1-36	2		Y	Fault Resets per Hour
A1-37	35% (*)		Y	Up To Speed Level
C1-1	Multi_Step		Y	Speed Command Source
C1-2	External Tbl		Y	Run Command Source
C1-11	Automatic		Y	Fault Reset Source

A2.2.2 Drive Gain Adjustment Parameter

The "Drive Gain" parameter adjusts the sensitivity with which the drive follows the request speed pattern signal without undesirable vibration or discomfort. "Drive Gain" is adjusted, when required, by changing the parameter A1-3 in the drive A1 submenu. The drive is shipped with drive gain preset to the drive manufacturer's default. Increasing the value of this parameter increases the drive's responsiveness to speed pattern signal commands.

Parameter #	EC Setting	Hidden Item	Comments
Drive Gain for Closed Loop Vector Control			
A1-3	10.00(*)	N	Response Speed Regulation and control

A2.2.3 Motor Speed Calibration

The "Motor Speed" parameter is adjusted, when required, by changing the speed parameters, under MultiStep Ref A3 menu, Speed Command 1 through 15, to set various speeds required for the job. The higher the frequency value, as reflected by a higher parameter setting, the faster the speed of the car when speed is selected.

Parameter #	EC Setting	Hidden Item	Comments
Res. 0 Speed	0 Ft/Min	N	Zero Speed command Not Programmable
A3-1	4 Ft/Min	N	(L1) Leveling speed
A3-2	6 Ft/Min	N	(L2) Re-leveling speed
A3-4	30 Ft/Min	N	(HL) High leveling / Inspection speed
A3-6	(*)Ft/Min	N	(H) Contract speed
A3-7	50 Ft/Min	N	(EQS) Earthquake speed

✍ **NOTE**: Zero Speed is commanded by not selecting any of the speed commands, and keeping the drive enable and direction selection active.

The relationship between car speed and motor speed parameter settings is based on Ft/ Min Vs Motor Rotation (RPM). To match the actual car speed to the desired car speed, determine the speed in Ft/ Min by measuring the actual car speed with a hand held tachometer, use measure value to calibrate car speed as follows:

a. Place the car on Controller Inspection.

b. Run the car on Inspection mode, up or down. Measure and record the actual car speed in Ft/ Min.

c. Compare measured Ft/ Min speed Vs Programmed Ft/ Min speed in A3-4 Inspection speed, if speeds agree, calibration is complete

d. If speeds disagree increment or decrement the value of Parameter A1-2 Contract Motor speed RPM to get speeds to agree with each other.

✍ **NOTE**: Speed calibration for contract speed will need to be verified and adjusted if needed, follow steps a through d above but replace A3-4 with A3-6 Contract speed on step c.

✍ **NOTE**: Speed settings, acceleration/deceleration rates, s-curve, and gain parameter initial and calculated values may need to be fine-tuned during final adjustment procedure.

A2.2.4 Analog Inputs

The drive analog inputs are not used for this control system application.

A2.2.5 Analog Outputs

These drive parameters configure the drive analog outputs to generate an actual car speed curve profile for speed monitoring, which can be observed with an oscilloscope for final ride tuning between terminals TB1-33 and TB1-34.

Parameter #	EC Setting	Terminal #	Hidden Item	Comments
C4-1	Speed Feedback	TB1-33	Y	Motor speed output

A2.2.6 Digital Outputs

These drive parameter configure the drive digital outputs to send drive operation mode signals to the Elevator Controls V900 Non-PVF controller.

Parameter #	EC Setting	Terminal #	Hidden Item	Comments
C3-1	Up To Speed	TB1-14	A	Output to turn on LSSM speed monitor
A1-27	10% (*)		Y	Percentage of Speed to turn on LSSM

A2.2.7 Digital Inputs

These drive parameters configure the drive digital inputs to receive digital commands from the Elevator Controls V900 Non-PVF controller.

Parameter #	EC Setting	Terminal #	Hidden Item	Comments
C2-1	Drive Enable	TB1-1	Y	Drive Enable to Run Input
C2-2	Run Up	TB1-2	Y	Run Up Direction Input
C2-3	Run Down	TB1-3	Y	Run Down Direction Input
C2-4	Fault Reset	TB1-4	Y	External Reset Input
C2-5	Step Ref B0	TB1-5	Y	Multi-Step Frequency Reference 1
C2-6	Step Ref B1	TB1-6	Y	Multi-Step Frequency Reference 2
C2-7	Step Ref B2	TB1-7	Y	Multi-Step Frequency Reference 3
C2-8	No Function	TB1-8	Y	Disable Input Terminal 8
C2-9	No Function	TB1-9	Y	Disable Input Terminal 9

A2.2.8 Section Intentionally Left Blank

A2.2.9 Motor Setup

These drive parameters configure the drive for the hoist motor.

Parameter #	EC Setting		Hidden Item	Comments
A4-5	10 (*)		N	Drive Carrier Frequency
A4-8	(*)		Y	Filter Reactance if provided
A4-9	Line Voltage (*)		N	Drive Input Voltage
A5-1	Motor ID (*)		N	Motor full load amps on nameplate
A5-2	Motor HP (*)		N	Motor Horse Power From Name Plate
A5-3	Motor Voltage (*)		N	Motor Armature Rated Voltage
A5-4	Rated Frequency (*)		N	Motor Armature Rated Frequency
A5-5	Rated Current (*)		N	Motor Armature Rated Current
A5-6	Number of Poles (*)		N	Motor Number of Poles, 900= 8, 1200= 6, 1800 = 4.
A5-7	Rated Motor Speed (*)		N	Required RPM for Contact Speed.
A5-8	35% (*)		N	No Load Armature Current

A2.2.10 Acceleration Deceleration and "S" Curve Parameters

These drive parameters configure the speed profile the drive will generate to start, accelerate, decelerate and stop the car. Refer to Section 4.6 of this manual for configuration and speed profile details.

Parameter #	EC Setting		Access Level	Comments
A2-1	3 Ft/Sec (*)		Q	Acceleration time 1
A2-2	3 Ft/Sec (*)		Q	Deceleration time 1
A2-10	3 Ft/Sec (*)		A	Deceleration time 2
A2-3	8 Ft/Sec (*)		A	S-curve at acceleration start
A2-3	8 Ft/Sec (*)		A	S-curve at acceleration end
A2-3	8 Ft/Sec (*)		A	S-curve at deceleration start
A2-4	8 Ft/Sec (*)		A	S-curve at deceleration end

A2.3 Overspeed Using the Drive to Drive the Hoist Motor

The drive unit can be configured to run the hoist motor at a higher frequency than the hoist motor base input frequency to create an overspeed condition as follows:

a. Place the car on Test Mode of operation.
b. Run the car to a (terminal) landing.
c. Program parameter A1-16, Overspeed Multiplier, to 125% to allow the car to run at 125% of contract speed.

d. Use U0 submenu to select OVRSPEED TEST U4. Refer to Section 3.6.4.3 of the Drive Manual, Overspeed Test via Operator, for a detailed overspeed test description.
e. Place a car call several floors above or below the current floor to allow car to attain overspeed.
f. The drive will reset to non-overspeed mode when the run command is removed at the end of each run. Repeat step d above for every test run required.

WARNING: When performing an overspeed test, make sure all parameters are **RESET TO THEIR ORIGINAL VALUES** when testing is completed.

Appendix A3
Magnetek HPV-600 AC Vector Drive Unit

A3 Motor Drive Parameters

A3.1 Drive Operational Overview

Review and become familiar with the MAGNETEK HPV-600 Drive User Manual. For simplified reference we will refer to it as the Drive Manual.

Pay particular attention to all safety precautions. Study the job prints, noting that the interface to the drive consists of basic drive inputs including:

a. Direction / run inputs

e. Speed selection signal inputs

f. Power inputs to terminals R, S and T

g. Encoder inputs, for closed loop vector control application only

The basic outputs are:

h. 3-Phase output to motor through contactor

i. Fault output (drops DSAF relay if a fault condition is detected)

j. Drive run output

k. ABS speed output

CAUTION: Do not connect the building power supply directly to the motor contactor.

WARNING: Power capacitors in the drive remain charged for some time after power is removed. Use care to prevent injury.

Familiarize yourself with the use of the drive's Digital Operator in the Drive Manual Parameters Section 3, starting on page 37, including use of the keypad as described below.

There are two types of parameters, standard and hidden. Parameter access levels are set in the drive's Utility UO menu, parameter U2 – Hidden Items. Note that the hidden parameters are only accessible when U2 – Hidden Items is “enabled”. Refer to the Utility Section U0 menu, page 127 in the Drive Manual, for use of the utility functions.

NOTE: The Adaptive Tune procedure can be used to auto-tune the motor drive. This function will calculate the required motor parameter settings for optimized motor performance. This procedure is explained in the ADAPTIVE TUNE section of the HPV-600 Drive Manual, pages 20-23.

✍ **NOTE**: Do not change any parameters except those found in the following tables. Other parameters are either not used in this particular application or are pre-programmed to EC default settings.

Verify that the parameters are as listed on the job-programming list supplied with the Elevator Controls job prints. Parameters listed below have been changed from the drive manufacturer defaults by Elevator Controls. Parameters noted (*) may need to be fine tuned during adjustment.

A3.2 HPV-600 Drive Parameter Programming

The HPV-600 drive is used in both Closed Loop Vector Control with Encoder Feedback, and an optional encoder feedback board installed and attached to Port #1 in the drive unit, or Open Loop Vector Control without encoder feedback the difference between them is the drive operation mode and the stopping method of control "Ramp to Stop" for closed loop and "DC-Injection" for open loop, and the additional encoder feedback on Closed Loop Vector Control, with the following parameters configurations:

Parameter #	EC Setting	Hidden Item	Comments
Drive Configuration and Stopping Method for Open Loop Vector Control only			
A1-9	50% (*)	N	DC current applied at start of a run.
A1-10	75% (*)	N	DC current applied at Braking to Stop.
A1-11	Speed Command 2 – 0.5 Hz (*)	N	Frequency command at which DC current will be applied to generate a control stop, set below leveling speed command.
A1-12	0	N	DC Injection time at start = 0 sec (used if rollback)
A1-13	1 to 2 seconds (*)	N	DC Injection time at stop.

✍ NOTE: For Closed Loop Vector Control systems only: The encoder feedback unit (attached to the hoist motor) Pulses per Revolution data must match the programmed value in Encoder Pulses parameter, and must be set to 0 if drive used in Open Loop Vector Control mode.

A3.2.1 System Constants

These drive parameters configure the drive for Elevator Control's V900 Non-PVF operation

Parameter #	EC Setting		Hidden Item	Comments
A1-1	(*)		N	Contract Car Speed in Ft/Min
A1-2	(*)		N	Contract Motor Speed In RPM
A1-14	140 (*)		Y	Overspeed Multiplier
A1-17	(*)		N	Encoder Pulses per Revolution
A1-35	3 seconds		Y	Fault Reset Delay
A1-36	2		Y	Fault Resets per Hour
A1-37	35% (*)		Y	Up To Speed Level
C1-1	Multi_Step		Y	Speed Command Source
C1-2	External Tbl		Y	Run Command Source
C1-11	Automatic		Y	Fault Reset Source

A3.2.2 Drive Gain Adjustment Parameter

The "Drive Gain" parameter adjusts the sensitivity with which the drive follows the request speed pattern signal without undesirable vibration or discomfort. "Drive Gain" is adjusted, when required, by changing the parameter A1-3 in the drive A1 submenu. The drive is shipped with drive gain preset to the drive manufacturer's default. Increasing the value of this parameter increases the drive's responsiveness to speed pattern signal commands.

Parameter #	EC Setting	Hidden Item	Comments
Drive Gain for Closed Loop Vector Control			
A1-3	10.00(*)	N	Response Speed Regulation and control.

A3.2.3 Motor Speed Calibration

The "Motor Speed" parameter is adjusted, when required, by changing the speed parameters, under MultiStep Ref A3 menu, Speed Command 1 through 15, to set various speeds required for the job. The higher the frequency value, as reflected by a higher parameter setting, the faster the speed of the car when speed is selected.

Parameter #	EC Setting	Hidden Item	Comments
Res. 0 Speed	0 Ft/Min	N	Zero Speed command Not Programmable
A3-1	4 Ft/Min	N	(L1) Leveling speed
A3-2	6 Ft/Min	N	(L2) Re-leveling speed
A3-4	30 Ft/Min	N	(HL) High leveling / Inspection speed
A3-6	Contract Speed	N	(H) Contract speed
A3-7	50 Ft/Min	N	(EQS) Earthquake speed

✍ **NOTE**: Zero Speed is commanded by not selecting any of the speed commands, and keeping the drive enable and direction selection active.

The relationship between car speed and motor speed parameter settings is based on Ft/ Min Vs Motor Rotation (RPM). To match the actual car speed to the desired car speed, determine the speed in Ft/ Min by measuring the actual car speed with a hand held tachometer, use measure value to calibrate car speed as follows:

a. Place the car on Controller Inspection.

b. Run the car on Inspection mode, up or down. Measure and record the actual car speed in Ft/ Min.

c. Compare measured Ft/ Min speed Vs Programmed Ft/ Min speed in A3-4 Inspection speed, if speeds agree, calibration is complete

d. If speeds disagree increment or decrement the value of Parameter A1-2 Contract Motor speed RPM to get speeds to agree with each other.

✍ **NOTE**: Speed calibration for contract speed will need to be verified and adjusted if needed, follow steps a through d above but replace A3-4 with A3-6 Contract speed on step c.

✍ **NOTE**: Speed settings, acceleration/deceleration rates, s-curve, and gain parameter initial and calculated values may need to be fine-tuned during final adjustment procedure.

A3.2.4 Analog Inputs

The drive analog inputs are not used for this control system application.

A3.2.5 Analog Outputs

These drive parameters configure the drive analog outputs to generate an actual car speed curve profile for speed monitoring, which can be observed with an oscilloscope for final ride tuning between terminals TB1-A1 and TB1-A2.

Parameter #	EC Setting	Terminal #	Hidden Item	Comments
C4-1	Speed Feedback	TB1-A1	Y	Motor speed output

A3.2.6 Digital Outputs

These drive parameter configure the drive digital outputs to send drive operation mode signals to the Elevator Controls V900 Non-PVF controller.

Parameter #	EC Setting	Terminal #	Hidden Item	Comments
C3-1	Up To Speed	TB1-14	A	Output to turn on LSSM speed monitor
A1-27	10% (*)		Y	Percentage to turn on LSSM output

A3.2.7 Digital Inputs

These drive parameters configure the drive digital inputs to receive digital commands from the Elevator Controls V900 Non-PVF controller.

Parameter #	EC Setting	Terminal #	Hidden Item	Comments
C2-1	Drive Enable	TB1-1	Y	Drive Enable to Run Input
C2-2	Run Up	TB1-2	Y	Run Up Direction Input
C2-3	Run Down	TB1-3	Y	Run Down Direction Input
C2-4	Fault Reset	TB1-4	Y	External Reset Input
C2-5	Step Ref B0	TB1-5	Y	Multi-Step Frequency Reference 1
C2-6	Step Ref B1	TB1-6	Y	Multi-Step Frequency Reference 2
C2-7	Step Ref B2	TB1-7	Y	Multi-Step Frequency Reference 3
C2-8	No Function	TB1-8	Y	Disable Input Terminal 8
C2-9	No Function	TB1-9	Y	Disable Input Terminal 9

A3.2.8 Section Intentionally Left Blank

A3.2.9 Motor Setup

These drive parameters configure the drive for the hoist motor.

Parameter #	EC Setting		Hidden Item	Comments
A4-5	10 (*)		N	Drive Carrier Frequency
A4-8	(*)		Y	Filter Reactance if provided
A4-9	Line Voltage (*)		N	Drive Input Voltage
A5-1	Motor ID (*)		N	Motor full load amps on nameplate
A5-2	Motor HP (*)		N	Motor Horse Power From Name Plate
A5-3	Motor Voltage (*)		N	Motor Armature Rated Voltage
A5-4	Rated Frequency (*)		N	Motor Armature Rated Frequency
A5-5	Rated Current (*)		N	Motor Armature Rated Current
A5-6	Number of Poles (*)		N	Motor Number of Poles, 900= 8, 1200= 6, 1800 = 4.
A5-7	Rated Motor Speed (*)		N	Required RPM for Contact Speed.
A5-8	35% (*)		N	No Load Armature Current

A3.2.10 Acceleration Deceleration and "S" Curve Parameters

These drive parameters configure the speed profile the drive will generate to start, accelerate, decelerate and stop the car. Refer to Section 4.6 of this manual for configuration and speed profile details.

Parameter #	EC Setting		Access Level	Comments
A2-1	3 Ft/Sec (*)		Q	Acceleration time 1
A2-2	3 Ft/Sec (*)		Q	Deceleration time 1
A2-10	3 Ft/Sec (*)		A	Deceleration time 2
A2-3	8 Ft/Sec (*)		A	S-curve at acceleration start
A2-3	8 Ft/Sec (*)		A	S-curve at acceleration end
A2-3	8 Ft/Sec (*)		A	S-curve at deceleration start
A2-4	8 Ft/Sec (*)		A	S-curve at deceleration end

A3.3 Overspeed Using the Drive to Drive the Hoist Motor

The drive unit can be configured to run the hoist motor at a higher frequency than the hoist motor base input frequency to create an overspeed condition as follows:

a. Place the car on Test Mode of operation.
b. Run the car to a (terminal) landing.
c. Program parameter A1-16, Overspeed Multiplier, to 125% to allow the car to run at 125% of contract speed.

d. Use U0 submenu to select OVRSPEED TEST U4. Refer to Section 3.6.4.3 of the Drive Manual, Overspeed Test Via Operator, for a detailed overspeed test description.
e. Place a car call several floors above or below the current floor to allow car to attain overspeed.
f. The drive will reset to non-overspeed mode when the run command is removed at the end of each run. Repeat step d above for every test run required.

WARNING: When performing an overspeed test, make sure all parameters are **RESET TO THEIR ORIGINAL VALUES** when testing is completed.

Appendix A4
KEB Combivert F5 Motor Drive Unit

A4 Motor Drive Parameters

A4.1 Drive Parameters Overview

Review and become familiar with the KEB Combivert F5 Motor Drive Unit, Technical Manual. For simplified reference we will refer to it as the Drive Manual.

Pay particular attention to all safety precautions. Study the job prints, noting that the interface to the drive consists of basic drive inputs including:

a. Direction / run input

b. Speed selection signal inputs

c. Power inputs to terminals L1, L2 and L3

d. Encoder inputs

The basic outputs are:

a. 3-Phase output to motor through contactor

b. Fault output (drops DSAF relay if a fault condition is detected)

c. Drive run output

d. ABS speed output

CAUTION: Do not connect the building power supply directly to the motor contactor.

WARNING: Power capacitors in the drive remain charged for some time after power is removed. Use care to prevent injury.

Familiarize yourself with use of the motor drive's Digital Operator in the drive manual, Section 4 – Operation of the unit, to verify and/or set parameters.

NOTE: The KEB Combivert F5 Motor Drive Unit set up directions below are for Gearless Permanent Magnet AC motor applications.

NOTE: Do not change any parameters except those found in the following tables. Other parameters are either not used in this particular application or are pre-programmed to EC default settings.

Verify that the parameters are as listed on the job-programming list supplied with the Elevator Controls job prints. Parameters listed below have been changed from the drive manufacturer defaults by Elevator Controls. Parameters noted (*) may need to be fine tuned during adjustment.

A4.2 KEB Combivert F5 Parameter Programming

The KEB Combivert F5 drive unit when used to drive Permanent Magnet Motor elevator applications has to be preset before any car movement is attempted as follows:

1. Verify all parameters programming vs. motor and encoder nameplate data tags.
2. Read through section 4.2 to become familiar with drive parameters and terminal applications.
3. The drive unit needs to measure several motor parameters for optimum performance as follows:

3.1 Measure the motor resistance:

Refer to section 5.6.3 Auto-Tuning PM motors in Convibert F5 drive manual for instruction performing this procedure.

3.2 Absolute Encoder Set Up, to accomplish this set up procedure refer to section 5.11, Running the Motor, in the drive manual, make sure to read complete section before starting to execute procedure. Utilize the encoder feedback parameter LF.28 setting to accomplish proper motor rotational direction in conjunction with proper encoder directional rotation.

Encoder Feedback Settings

Parameter	EC Setting	Units
LF.26 Encoder Feedback	EnDat or HIPEr	EnDat or Hiperface
LF.27 Encoder Pulse Number	2048 (*)	Pulse Per Rev
LF.28 Reverse Encoder. 0= Nothing Reversed 1= A & B Encoder Channels Swapped 2= Motor Rotation Reversed 3= Motor Rotation Reversed, and A and B encoder channels swapped.	0 (*)	Number
LF.29 Encoder Sample Time	4	Mili-seconds

A4.2.1 System Constants

These drive parameters configure the drive for Elevator Control's V900 Non-PVF operation

Parameter	EC Setting	Units
LF. 2 Operating Mode	bnSPD	Binary Speed control.
LF. 3 Drive Configuration	Run	
LF. 4 Motor Selection	PgLSS	Gearless PM Motor
LF. 5 Number of Drive Auto-resets	3	
L5. 8 Motor Overload Protection	On	
LF.11 Rated Motor Speed	(*)	RPM from Motor Name Plate
LF.20 Contract Speed	(*)	Ft/ Min
LF.21 Traction Sheave Diameter	(*)	Inches
LF.22 Gear Reduction Ratio	1.00	See Note Below
LF.23 Roping Ratio	1	
LF.24 Load (Elevator Rated Capacity)	(*)	Lbs
LF.25 Estimated Gear Reduction	Read only parameter	See Note Below

LF.30 Control Method	2	Closed Loop

✍ **NOTE**: LF.25 can be used to determine the gear reduction ratio if it is not known. After correctly entering values into LF.11, LF.20, LF.21, and LF.23, read LF.25 value and enter value into LF.22. The final value for LF.22 will be set after running the car at contract speed.

A4.2.2 Drive Gain Adjustment Parameter

The "Drive Gain" parameter adjusts the sensitivity with which the drive follows the request speed pattern signal without undesirable vibration or discomfort. "Drive Gain" is adjusted, when required, by changing the parameters ALF.31 & dLF.31, Proportional Gain, ALF.32 & dLF.32, Integral Gain, and ALF.33 & dLF.33 Gain Offset at Low Speeds. The drive is shipped with drive gain preset to the drive manufacturer's default. Increasing the value of this parameters increases the drive's responsiveness to speed pattern signal commands.

Parameter	EC Setting	Units
ALF.31 Proportional Gain	3000(*)	Number
dLF.31 Proportional Gain	3000(*)	Number
ALF.32 Integral Gain	1000(*)	Number
dLF.32 Integral Gain	1000(*)	Number
ALF.33 Gain Offset at Low Speeds	2000(*)	Number
dLF.33 Gain Offset at Low Speeds	2000(*)	Number

A4.2.3 Motor Speed Calibration

The "Motor Speed" parameter is adjusted, when required, by changing the speed parameters, LF.41 through LF.47, to set various speeds required for the job. The higher the frequency value, as reflected by a higher parameter setting, the faster the speed of the car when speed is selected.

Parameter #	**EC Setting**	**Terminals**	**Comments**
LF.41	5 Ft/Min	X2A.11	(L1) Leveling Speed
LF.44	6 Ft/Min	X2A.12	(L2) Re-Leveling Speed
LF.42	40Ft/Min	X2A.13	(HL)High Intermediate Speed, used as Inspection Speed value also.
LF.46	Contact Speed	X2A.12 & 13	(H) High Speed
LF.47	50 FT/ Min	X2A.11,12 & 13	(EQS) Earthquake Speed

✍ **NOTE**: Zero Speed is commanded by not selecting any of the speed commands, and keeping the drive enable and direction selection active.

The relationship between car speed and motor speed parameter settings is based on Ft/ Min Vs Motor Rotation (RPM). To match the actual car speed to the desired car speed, determine the speed in Ft/ Min by measuring the actual car speed with a hand held tachometer, use measure value to calibrate car speed as follows:

a. Place the car on Controller Inspection.

b. Run the car on Inspection mode, up or down. Measure and record the actual car speed in Ft/ Min.

c. Compare measured Ft/ Min speed Vs Programmed Ft/ Min speed in LF.42 Inspection speed, if speeds agree, calibration is complete

d. If speeds disagree increment or decrement the value of Parameter LF.11 Contract Motor speed RPM to get speeds to agree with each other.

✍ **NOTE**: Speed calibration for contract speed will need to be verified and adjusted if needed, follow steps a through d above but replace LF.42 with LF.46 Contract speed on step c.

✍ **NOTE**: Speed settings, acceleration/deceleration rates, s-curve, and gain parameter initial and calculated values may need to be fine-tuned during final adjustment procedure.

A4.2.4 Analog Inputs

Drive Analog Input from the analog Load Weigher unit output used to pre-torque the drive unit motor drive output based on elevator cab weigh status.

Description	Signal Name	Terminal
Pre-torque Input	AN2+ and AN2-	X2A.24 to .26

A4.2.5 Analog Outputs

Drive analog output corresponding to the actual car speed, scaled to a +- 10 volts DC.

Description	Signal Name	Terminal
Analog Car Speed Output	ANAOU1 & COM	X2A.5 and X2A.8

A4.2.5 Digital Outputs

These drive parameter configure the drive digital outputs to send drive operation mode signals to the Elevator Controls V900 Non-PVF controller.

✍ **NOTE**: LF.41 and do.81 are used to turn on the LSSM speed monitor board threshold output at two times LF.41 setting to drive the LSSM-5 Tachometer Loss input enable.

Parameter	EC Setting	Terminal
do.81 Speed percentage enable, Output to turn on LSSM speed monitor, on at 2 times leveling speed LF.41	Hsd	X2A.19
do.82 Drive ready	Rdy	X2A.24 to .26
do.83 Drive On Output	Dro	X2A.27 to .29

A4.2.7 Digital Inputs

These drive parameter configure the drive digital inputs to receive digital commands from the Elevator Controls V900 Non-PVF controller.

Parameter	EC Setting	Units
di. 0 Input source configuration	NPn	Sinking inputs

A4.2.8 Section Intentionally Left Blank

A4.2.9 Motor Parameters

These drive parameters configure the drive for the hoist motor.

Parameter	EC Setting	Units
LF.12 Rated Motor Current	(*)	Amps
LF.13 Rated Motor Frequency, per motor name plate	(*)	Hz
LF.14 Rated Motor Voltage	(*)	Volts
LF.17 Rated Motor Torque, per motor name plate	(*)	Lb ft
LF.18 Motor Stator Resistance, per motor name plate	(*)	**Ohms**
LF.19 Motor Leakage Inductance	(*)	Mili-Henries

✍ **NOTE**: The inductance listed on the motor manufacturer's data sheet will have to be multiplied by two if it is listed per motor phase.

A4.2.10 Acceleration Deceleration and "S" Curve Parameters

These drive parameters configure the speed profile the drive will generate to start, accelerate, decelerate and stop the car. Refer to Section 4.6 of this manual for configuration and speed profile details.

Parameter #	**EC Setting**	**Units**
LF.50 Starting Jerk	3.0 (*)	Ft/Sec Cube
LF.51 Acceleration	2.0o 3.0 (*)	Ft/Sec Square
LF.52 Roll Into Constant Speed Jerk	3.0 to 4.0 (*)	Ft/Sec Cube
LF.53 Deceleration Jerk	3.25 to 4.25 (*)	Ft/Sec Cube
LF.54 Deceleration	1.8 to 3.5 (*)	Ft/Sec Square
LF.55 Final Approach Jerk	2.5 (*)	Ft/Sec Cube
LF.56 Leveling to Final Stop Jerk	2.0 (*)	Ft/Sec Cube

A4.3 Overspeed Using the Drive to Drive the Hoist Motor

The drive unit can be configured to run the hoist motor at a frequency larger than the hoist motor base input frequency to create an overspeed condition as follows:

e. Place the car on Test mode.
f. Take the car to terminal Landing.
g. Increment Program parameter LF.23 to next value.
h. Place a Car Call several floors above/ below floor to allow car to attain overspeed.

✍ **NOTE**: Parameters LF.20 contract speed is in fpm, parameter the LF.21 sheave diameter in inches, parameter LF.22 gear ratio, and LF.23 roping ratio are used by the drive unit logic to scale the fpm contract speed value to the inverter's base unit of rpm. By increasing the roping ratio, this changes the scale to a higher rpm value for a given contract speed and also raises the inverter overspeed level, allowing an overspeed test on the elevator without tripping drive unit on overspeed fault.

WARNING: When performing an overspeed test. Make sure all parameters are **RESET TO THE ORIGINAL VALUE** when testing is completed.

Appendix B1
Magnetek DSD-412 SCR Drive Unit

B1 Motor Drive Parameters

B1.1 Drive Operational Overview

Review and become familiar with the MAGNETEK DSD-412 Drive User Manual. For simplified reference we will refer to it as the Drive Manual.

Pay particular attention to all safety precautions. Study the job prints, noting that the interface to the drive consists of basic drive inputs including:

a. Direction / run inputs
b. Speed selection signal inputs
c. Power inputs to terminals L1, L2 and L3
d. Encoder input

The basic outputs are:

a. Variable DC voltage output to motor through contactor
b. Motor field control
c. Fault output, drops DSAF relay if fault
d. Drive Run output

ABS Speed output

a. 3-Phase output to motor through contactor
b. Fault output (drops DSAF relay if a fault condition is detected)
c. Drive run output
d. ABS speed output

CAUTION: Do not connect the building power supply directly to the motor contactor.

Familiarize yourself with the drive's Standard Control / Display Operation, described in Section 3 of drive manual.

NOTE: Verify that the parameters are as listed on the job-programming list supplied with the elevator controller job prints (page 4 within the drive unit block diagram interface area). Parameters that are not listed in the following tables may not be used, or are used as programmed per the factory default value only.

Parameters listed below have been changed from the drive manufacturer defaults by Elevator Controls. Parameters noted (*) may need to be fine tuned during adjustment.

Section 3.7 of Drive Manual details the use of function #994 to save any changed value. Any changes or adjustments will be returned to previous values if power is turned OFF or the drive is reset unless settings are saved using the function #994 with the NVRAM switch in the proper position.

✍ **NOTE**: The SCR Drive "Ready" light and output are not sensitive to input power phase rotation, but they will fault if one or more phases are lost.

✍ **NOTE**: It is necessary to tune the SCR Drive to the motor. In order to do so, perform a drive SELF-TUNE operation, function #997 (refer to Section 3.8 of Drive Manual). The motor contactor will energize, and current will flow to the motor armature, but the car will not be required to move during this procedure.

B1.2 DSD-412 Drive Parameter Programming

B1.2.1 System Constants

These drive parameters configure the drive for Elevator Control's V900 Non-PVF operation.

Parameter #	EC Setting		Comments
17	(*)		Contract Car Speed in Ft/ Min
11	(*)		Contract Motor Speed In RPM
10	(*)		Encoder Unit Pulses Per Revolution
81	140 (*)		Overspeed Multiplier
10	(*)		Encoder Pulses per Revolution
101	1=ON		Auto Fault Reset On
102	ON		3 Loops Wait for Contactor Fault Detect
64	35% (*)		Up To Speed Level
110	2		Terminals Multi Speed Command Source

B1.2.2 Drive Gain Adjustment Parameter

The "Drive Gain" parameter adjusts the sensitivity with which the drive follows the request speed pattern signal without undesirable vibration or discomfort. "Drive Gain" is adjusted, when required, by changing the parameter 42 in the drive. The drive is shipped with drive gain preset to the drive manufacturer's default. Increasing the value of this parameter increases the drive's responsiveness to speed pattern signal commands.

Parameter #	EC Setting		Comments
42	1 (*)		Response Speed Regulation and control.

B1.2.3 Motor Speed Calibration

The "Motor Speed" parameter is adjusted, when required, by changing the Pre-Set Speed Parameters 151 to 157 to set various speeds required for the job. The higher the RPM value, as reflected by a higher parameter setting, the faster the speed of the car when speed is selected.

Parameter #	EC Setting	Terminal #	Comments

Res. 0 Speed	0 RPM	None	Zero Speed command
151	4 Ft/ Min	TB1-11	(L) Leveling speed
152	6 Ft/ Min	TB1-53	(L2) Re-leveling speed
154	40 Ft/ Min	TB1-12	(HL) High leveling / Inspection speed
156	Contract Speed	TB1-12 & 53	(H) RPM equal to Rated speed
157	50 Ft/ Min	TB1-11,12 & 53	(EQS) Earthquake speed

✍ **NOTE**: Zero Speed is commanded by not selecting any of the speed commands, and keeping the drive enable and direction selection active.

The relationship between car speed and motor speed parameter settings is based on Ft/ Min Vs Motor Rotation (RPM). To match the actual car speed to the desired car speed, determine the speed in Ft/ Min by measuring the actual car speed with a hand held tachometer, use measure value to calibrate car speed as follows:

a. Place the car on Controller Inspection.

b. Run the car on Inspection mode, up or down. Measure and record the actual car speed in Ft/ Min.

c. Compare measured Ft/ Min speed Vs Programmed Ft/ Min speed in 154 Inspection speed, if speeds agree, calibration is complete.

d. If speeds disagree increment or decrement the value of Parameter 11 Contract Motor speed RPM to get speeds to agree with each other.

✍ **NOTE**: Speed calibration for contract speed will need to be verified and adjusted if needed, follow steps a through d above but replace 154 with 157 Contract speed on step c.

✍ **NOTE**: Speed settings, acceleration/deceleration rates, s-curve, and gain parameter initial and calculated values may need to be fine-tuned during final adjustment procedure.

B1.2.4 Analog Inputs

The drive analog inputs are not used for this control system application.

B1.2.5 Analog Outputs

These drive parameters configure the drive analog outputs to generate an actual car speed curve profile for speed monitoring.

Parameter #	EC Setting	Terminal #	Comments
95	3	TB1-45	Motor Speed Feedback output
96	2	TB1-46	Commanded Speed
97	1		Motor Speed Output Multiplier
98	1 (*)		Commanded Speed Multiplier

B1.2.6 Digital Outputs

These drive parameter configure the drive digital outputs to send drive operation mode signals to the Elevator Controls V900 Non-PVF controller.

Parameter #	EC Setting	Terminal #	Comments
63	10% (*)		Percentage of contract speed to turn on LSSM output
183	3	TB1-36 & 37	Output to turn on LSSM speed monitor
184	Not Used	78	K4 logic Output
185	Not used	79	K5 logic Output
186	4	83	Brake Ready to be Lifted Output
187	Not Used	84	K6 logic Output

B1.2.7 Digital Inputs

These drive parameter configure the drive digital inputs to receive digital commands from the Elevator Controls V900 Non-PVF controller.

Parameter #	EC Setting	Terminal #	Comments
115	0	TB1-8 or 50	Drive Enable to Run Input

B1.2.8 Section Intentionally Left Blank

B1.2.9 Motor Setup

These drive parameters configure the drive for the hoist motor.

Parameter #	EC Setting		Comments
3	(*)		Motor Armature Full Load Current
7	(*)		Motor Armature Full Voltage
9	Line Voltage (*)		Drive Input Voltage
49	(*)		Motor Field full Speed Running Voltage
50	(*)		Motor Field Full Load Current
52	(*)		Motor Field Rated Voltage
53	(*)		Motor Field Standing Current
55	(*)		Field Control Voltage Input, used only when field supply is different from main drive power supply, leave set to 0 if Field and drive supply are the same.

B1.2.10 Acceleration Deceleration and "S" Curve Parameters

These drive parameters configure the speed profile the drive will generate to start, accelerate, decelerate and stop the car. Refer to Section 4.6 of this manual for configuration and speed profile details.

Parameter #	EC Setting		Comments

170	3.5 Sec (*)		Acceleration time 1
171	0.1 Sec (*)		Acceleration time 2
172	2.0 (*)		Deceleration time 1
173	0.0		Deceleration time 2
174	35% (*)		S-curve at acceleration 1
175	0%		S-curve at acceleration 2
176	35% (*)		S-curve at deceleration 1
177	0%		S-curve at deceleration 2

B1.3 Overspeed Using the Drive to Drive the Hoist Motor

The drive unit can be configured to run the hoist motor at a higher frequency than the hoist motor base RPM to create an overspeed condition as follows:

a. Place the car on Test Mode of operation.
b. Run the car to a (terminal) landing.
a. Function 81 Over-Speed Multiplier has been programmed to 140%, to allow the car to run at 140% of contract speed.
b. Set Function 12 to 150%, to prevent drive overspeed trip.
c. Set Parameter 80 to 1, Over-Speed Test On.
d. Place a car call several floors above or below the current floor to allow car to attain overspeed.
e. Repeat steps above for every test run required.

WARNING: When performing an overspeed test, make sure all parameters are **RESET TO THEIR ORIGINAL VALUES** when testing is completed.